External Facade Systems Specifications

外幕墙系统技术规格说明书

Suzhou Zhongnan Center

suzhou, China

苏州中南中心

中国苏州

ALT LIMITED

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PART 1 – GENERAL

第一部分–一般说明

1.01 GENERAL REQUIREMENTS 一般要求

A. All work in this section shall comply with the requirements of the contract, including general and special conditions, along with the drawings and all other contract documents. In addition, all work shall be executed to meet all applicable requirements of the building regulations in Suzhou, China.
本工程所有工作均须符合合约中所有要求，包含一般和特殊工况下的工作，遵循图纸以及所有其他合约文件。另外，所有的工作都应实施时满足所有中国苏州市建筑法规的应用要求。

B. The External Facade Systems are to enclose 499 meters height office tower building and Sunken Entrance. The External Facade System specified in this section shall include: glass curtain wall, aluminum claddings, aluminum louvers/grilles, glass wall point fixings with cable, stone cladding, skylight, stick system for observation deck and Roof at crown.
外幕墙系统包括499米高的办公楼及下沉入口。本章的外幕墙系统应该包括：玻璃幕墙、铝板幕墙、铝合金百叶/格栅，点玻拉索幕墙、石材幕墙、采光顶等,观光阁框架幕墙、塔冠屋面格栅幕墙。

C. The External Facade System is a unitized, stick type, semi-unitized and patch fixing glass wall with cable, stone cladding and skylights. The facade system shall include all curtain wall framing, support, features, panels, louvers, grilles, vertical exterior features, closures, cladding, soffits, glass, glazing sealant, back pans, flashings, anchors, exterior maintenance tracksystem, integration of external lighting, signage, and its supports and all other components for the complete system and its installation.
外幕墙系统包含单元式幕墙系统，框架式幕墙系统，半单元式幕墙系统、点玻拉索幕墙、石材幕墙及采光顶系统。包括幕墙框架、支撑、装饰构件、板材、百叶、格栅、室外垂直装饰、封修、室外吊顶、玻璃、密封胶、背板、庇水板、锚固件、与广告标识、外部照明及其支架的配合工作，以及其他相关的构件及其安装。

D. It is the prime responsibility of the External Facade Contractor to ensure the water-tightness and the structural stability of all the External Facade Systems. Any defect or leakage found within the Warranty Period shall be sealed and made good, all at the expense of the External Facade Contractor.
确保幕墙的水密性和所有幕墙系统的结构稳定性均由外幕墙承包商承担主要责任。在保质期内如果幕墙出现任何缺陷或渗漏，应重新打胶密封并维修至完好，花费全由外幕墙承包商承担。

E. Design Responsibility
设计责任

1. This specification shall be read in conjunction with the Contract Documents and other technical specifications for the Project.

   本技术规格说明书针对本项目应配合本工程的合约文件及其它技术规范同时使用

2. This specification and the architectural drawings are for defining the design intent and performance requirements, while the External Facade Contractor is responsible for the design, structural calculations, technical performance, shop drawings, material installation, warranties and related documentation as required herein.
   本技术规格说明书以及建筑图主要是为了明确设计意图和性能要求。外幕墙承包商须负责深化设计、结构计算、技术性能、施工图纸、材料安装、质保及要求的相关文件。

3. The architectural drawings shown are diagrammatic and shall be intended as a guide for the aesthetic and interfacing requirements of the various components of the curtain wall to and with other work. The requirements shown by the details are intended to establish basic dimensions of the module and sight lines, jointing and profiles of members. The drawings' intents shall not be construed as engineering design, or adequate to meet the engineering design requirements. The External Facade Contractor shall be responsible for the design and engineering of the system within these aesthetic parameters.
   建筑图纸示意仅作为各幕墙类型的美学和各不同构件或材料的交接要求以及幕墙与其他专业工作的交接的指导，而节点图中体现的要求意在明确幕墙的分格尺寸和外视线，规定胶缝及型材构件尺寸等，图纸的意图不应直接用于结构设计或认为其满足结构设计的要求，幕墙分包商应在满足这些美学参数的前提下，全权负责幕墙的结构和系统设计。

4. The External Facade Contractor shall be responsible for the quality and timely completion of the External Facade Systems and shall undertake the Scope of Work described in these specifications in accordance with approved standards.
   幕墙承包商须负责本技术规格说明书所述的工作范围内的幕墙系统的设计及施工质量，保证品质，并如期完工。

5. The External Facade Contractor shall be responsible for ensuring the structural integrity and performance of the External Facade Systems. The External Facade Contractor shall design and engineer the External Facade Systems through Shop Drawings to conform to the criteria provided in these specifications.
   幕墙承包商须负责本项目幕墙系统的结构完整性及系统的性能可靠，并遵照本技术规格说明书规定的标准来进行深化设计和结构计算，完成施工图纸设计

6. The External Facade Contractor shall be responsible for ensuring the thermal performance and meet the LEED GOLD and China Greenstar (2 Star) requirements of the External Facade System. The External Facade

Contractor shall, perform thermal analysis and energy study to conform to the criteria provided in this specification.
外幕墙承包商须负责确保本工程外墙系统热工性能并符合LEED的GOLD及中国绿色节能(2星)的要求，遵照本技术规格说明书规定的标准进行热工性能分析和能耗研究。

7. It is recognized that the bid drawings included in the Tender Documents, do not cover certain conditions or may require modifications. It is intended, however, that the conditions not detailed or requiring modifications shall be developed by the External Facade Contractor through Shop Drawings at the same level of architectural aesthetics as the bid drawings and in compliance with the performance criteria indicated for the detailed areas and/or stipulated in these specifications. The External Facade Contractor, by accepting the contract for the works, acknowledges this and agrees that the Design Architect shall have the final say on the aesthetics feature whether detailed or not in the bid drawings.
须明确的是，招标文件提供的招标图并未涵盖本项目中的所有的工况，图纸也或将需修改。也就是说，对于这些没有节点反映到的工况或者将会需要修改的地方，幕墙承包商须遵照招标图纸表达的美学理念和类似节点显示的以及技术规格说明书中规定的性能标准，进行深化设计并显示在施工图纸中。幕墙承包商一旦承接本工程，即表示其了解和同意该条款，且建筑师在美学装饰方面，不论招标图纸是否有示意，均拥有最终的话语权。

8. The External Facade Contractor shall further ensure the structural/performance integrity of the External Facade Systems by erecting prototypes or mock-ups and subjecting this to appropriate testing procedures stipulated in these specifications.
幕墙承包商须通过建立模型或者建立实物样板依据本技术规格说明书规定的试验程序进行测试，以进一步确保幕墙系统的结构和性能的完整性。

9. The External Facade Contractor shall provide an accessible plant with ample space where it can fabricate and assemble the curtain wall and store both raw materials and finished products safely.
幕墙承包商应提供具有足够操作空间的厂房，既能够加工和组装幕墙板块和构件，也能够安全地存放原材料和已组装完成的板块。

10. The External Facade Contractor shall provide the necessary equipment and skilled manpower in order to install its works safely and with ease.
幕墙承包商须提供必要的设备及熟练的操作工人，以便安全熟练地完成本项目的安装工作。

11. The External Facade Contractor shall submit on time the requirements in the specified formats.
幕墙承包商须依据规定的格式，准时提交送审材料。

12. The External Facade Contractor as designer of the external facade system shall ensure that the overall thickness of each glass type, and the component thickness of each multiple layer glass type, as defined by contract documents or as required by structural criteria/stress analysis or

acoustical criteria shall be consistent throughout the project. (Thickness and heat treatment are the responsibility of the External Facade Contractor).
幕墙承包商作为幕墙系统的设计者，应该依据合约文件或结构设计标准/应力分析或声学标准的要求，保证整个项目中每种类型玻璃的总厚度和多层玻璃中的每片玻璃片的厚度。（玻璃的厚度和热处理方式的责任均应由幕墙分包商承担）

13. The External Facade Contractor as designer of the curtain wall shall provide anchor adjustment capability for the full range of specified tolerances for the building structure (three - way adjustment).
幕墙承包商作为幕墙系统的设计者，应提供可三向调节的挂件支座系统，具有足够的主体结构误差吸收能力。

14. Any discrepancies or contradictions in the drawings and specifications shall be brought to the attention of the Design Architect for clarification during the bid period by the bidders.
在图纸以及技术规格说明书有任何冲突或相异的地方，投标单位须于投标答疑期间提出给建筑师以便澄清。

15. The design shall comply with all building code requirements applicable in suzhou, China.
设计应满足中国苏州市所有相关建筑法规要求。

16. The External Façade Contractor shall provide all labor and supervision to complete his scope of work. The grade of labor supplied shall include competent craftsmen capable of performing activities to be undertaken by them. Sufficient manpower shall be supplied by the External Façade Contractor to meet the project completion schedule. All supervisory personnel shall be qualified and suitably experienced in their work classifications.
幕墙承包商应提供工人和管理人员来完成其施工范围内的工作，供应劳动力的等级划分应包含能够胜任相关工作的技术工人的能力，幕墙承包商应提供充足的工人以确保项目施工工期。所有的项目管理人员均应有相关工作的认证和具备合适的类似工作经验。

F. Acceptance of existing structure
现场结构的接收

1. Prior to the commencement of any section of the work the External Facade Contractor shall be required to carry out a detailed inspection and ensure that the existing structure is satisfactory for the purpose, having due regard for all the conditions and requirements of the Specification. It shall be the External Facade Contractor’s responsibility to take all necessary site measurements and to check all adjacent structure to the work or from which the work are supported. Full allowance shall be made to accommodate all necessary adjustment within the specified limits.
幕墙承包商在进行任何工作之前，都应实地检查已完成的主体结构，确认相关结构是否符合预期和技术说明书规定的要求。幕墙承包商应负责现场必要的实地测量，检查所有与幕墙相邻接的结构和幕墙需要

从中获得支撑的结构，根据技术说明书的要求，必要的调整应得到充分的认可。

2. Embedment
预埋件

a. Typical embedemnts for tower: for the typical embedment which connects to the main steel structure, the Exterior façade contractor has the full responsibility for the design development, factory supervion and final site inspection and acceptance. The design development includes the structural analsys, fabrication drawing and layout drawing. Curtain wall contactor response for fabrication of the embedment. The embedment weld on the steel structure should be carrying out in the factory by the steel structure manufacturer and layout will be reviewed by the curtain wall contactor.
塔楼标准预埋件：对于与主体钢结构有连接的标准埋件，由幕墙承包商进行预埋件的深化设计、驻场监造和最终验收。其中预埋件的深化设计包括埋件的结构计算、加工图及布置图。预埋件的加工由幕墙承包单位负责，由钢结构制作单位负责在工厂内将埋件与主体钢结构的焊接，并由幕墙承包单位复核其定位。

b. Typical and Non-typical embedment: for the typical and non-typical emebedment which dose not connect to the main steel structure, the exterior façade contactor has the full responsibility for the design development, supply and installation.
标准及非标准预埋件：对于与主体钢结构没有连接的标准及非标准埋件，由幕墙承包商进行预埋件的深化设计、供应及安装。

3. Post fix embeds or insert bolt for remedial work shall be provided by External Facade Contractor and shall be fixed by External Façade Contractor.
补救工作的后置埋件或锚栓应由外幕墙承包商提供，并由外幕墙承包商安装。

G. Related Requirements:
相关要求

1. Climate Conditions
气候条件

a. External Facade Contractor shall be familiar with climatic conditions prevailing inSuzhou, China. The design shall be sufficient to address the high air temperature and humidity prevalent during summer and contrasting low temperature and low humidity experienced in winter as specified in this specification Article 1.07 Paragraph E - Performance and Testing Requirements. The design shall be sufficient to address all other climate conditions such as rainfall intensity and air quality.
外幕墙承包商须熟悉中国苏州市的气候状况。设计须充分考虑到夏季普遍的高温及高湿度天气，以及冬天相对的低温及低湿度天气（本技术说明书中 1.07. 性能要求及测试规定 D 部分已作出详

细要求）。设计还应充分考虑到其他的气候条件，比如降雨量和空气质量。

b. The External Facade Contractor by submitting a tender shall warrant that all materials and items of equipment are suitable for continued use and/or operation in climate conditions encountered. External Facade Contractor shall ensure that the provided materials and equipment will satisfy climate conditions.
幕墙承包商在招标文件中保证，所有的材料和设备均适合在上述的气候条件下连续使用或正常运作，同时还要保证其提供的所有材料和设备都适应当地气候条件。

2. Notation

符号

a. Notations and symbols used throughout tender documents shall be as listed on External Facade Wall Contract Drawings.
招标文件中所用到的符号和标示等将在外幕墙合同图中列出。

b. All other notations used shall have their normally accepted meaning and where any doubt or ambiguity is found. External Facade Contractor shall seek clarification in writing from the Design Architect before submission of tender. In the absence of a written clarification before acceptance of tender, External Facade Contractor shall be compliant in all aspects with this Specification and other contract documents to the satisfaction of the Client Representative.
所有其他使用过的符号都应具有通常被接受的意思，如果发现有任何异议或不清楚的地方，幕墙分包商必须在递交标书前业主寻求书面澄清。在业主接受标书前，幕墙分包商并未提出书面的澄清要求，则可被认为其接受本技术说明书及其他合同文件的所有要求，且符合业主的意图。

3. Local Statutory Obligations, Standards and Regulations
地方法律职责、标准及规范

a. The whole of external facade wall Contract work shall be consistent with good practice in Suzhou, China to the satisfaction of the Client Representative.
合同内的所有幕墙工作应符合中国苏州市当地的常规做法并得到业主代表的认可。

b. Perform all work in accordance with all Suzhou, China building regulations, by-laws, and requirements of the local authority in effect. Contract Work shall fully comply with all statutory obligations and regulations together with any amendments made thereto as required by, but not limited to, the following bodies.
所有的工作须符合中国苏州有关的房建规则，通过法律及地方当局法规生效。合同工作须完全符合下列的（但不限于）法令、法规及任何其他的要求：

i. Suzhou Municipal Commission of Construction

苏州市建设委员会

ii. Suzhou Municipal Bureau of Land and Resources
苏州市国土资源局

iii. Suzhou Municipal Bureau of Public Security
苏州市公安局

iv. Suzhou Water Authority
苏州市水务局

v. Suzhou Municipal Bureau of Labor and Social Security
苏州市劳动和社会保障局

vi. Suzhou Municipal Bureau Environmental Protection; and any other local authority having jurisdiction.
苏州市环境保护局和其它有管辖权的地方当局

c. External Facade Contractor shall arrange for all submissions, pay cost of statutory inspections and certificates.
外幕墙承包商须安排所有的应递交文件，并支付相关的法定检查和认证费用。

4. Metric Units

公制单位

a. External Facade Contractor shall provide all information and dimensions, including shop drawings, calculations, manufacturers' data, materials, and other submissions, in Metric Units and bilingual.
外幕墙承包商应提供所有信息和尺寸，包括施工图、计算书、材料生产商数据、材料和其他信息应为公制单位并且中英文对照。

5. Construction Phasing

施工阶段

Construction for this project shall have several critical stages for External Facade Contractor to include in his worksand schedule. (See Specification and Preliminaries):
幕墙承包商的工作及施工进度计划中应涵盖本项目的几个重要阶段(参见技术规格说明书和正文前书页)：

a. Main contractor shall verify construction phasing and shall be defined in the External Facade Contractor scope of work.

总承包商应核查各个施工阶段并明确其属于幕墙承包商的工作范围

b. External Facade Contractor shall make all temporary provisions necessary for full enclosure of these floors prior to construction of floors above.

在上一楼层施工前，幕墙承包商应提供必要的临时封闭围护措施保护。

c. The External Facade Contractor shall be responsible in providing temporary flashing along the perimeter of the building at floors above occupied floors to maintain water tightness to the occupied floors.

幕墙承包商有责任在临时使用的楼层上部的楼层四周提供临时防水，以保证临时使用楼层不漏水。

6. Liaisons with Government Authorities

与政府部门沟通

a. It is the responsibility of External Facade Contractor to liaise with all relevant utility companies and government departments, and to make formal application on behalf of Owner; regarding any parts of the External Façade Systems work.

幕墙承包商应负责与所有的相关公共事业单位及政府部门保持沟通，并代业主方办理所有与幕墙相关的各项工作的正式提审。

b. Obtain any and all necessary approvals or permits as required by governing regulatory agencies; regarding any parts of the External Facade Systems work.

需要获得所有政府管制机构所要求的与幕墙相关的必要批复或许可证。

c. Due to time and procedures involved, External Facade Contractor shall ensure that all applications regarding their work are made on time.

在施工期间，外幕墙承包商要确保所有的工作都准时进行，避免延误总进度。

7. Drawings and Documents for Submissions to the Authorities

送审当局的施工图及文件

a. It is the responsibility of External Facade Contractor to ensure that all relevant drawings and documents or any part of the External Facade Systems Work shall be submitted well in advance for approval to all applicable authorities having jurisdiction over the project and utility companies to meet staging of work.if there are government department review requirement for Jangsu Province, the curtain wall contactor also need ensure approval from those relevant government department.

幕墙承包商有责任确保所有相关图纸和文件或所有与幕墙工作相关的资料应提前递交对本项目具有管辖权的政府部门及公共事业单位审核，以满足工程的实际进程。如涉及到江苏省省级单位或部门的审核要求，幕墙承包单位也应负责确保通过其审核。

b. Drawings shall be provided as specified at the same scales as built drawings, or as specified by all applicable authorities having jurisdiction over the project.

应按竣工图纸比例或对本项目具有管辖权的政府部门所规定的图纸比例提交图纸。

c. Drawings for submission shall be forwarded to the Main Contractor and Client Representative for review before submission.

送审的施工图须在正式递交政府送审前送交总承包商及业主代表审核。

d. External Facade Contractor shall ensure that his submissions will not delay subsequent inspection and testing procedures by Authorities concerned.

外幕墙承包商须保证其递交文件不耽误接下来的有关当局的检查及试验程序。

e. External Facade Contractor shall make submissions to all applicable authorities having jurisdiction over the project to meet inspection dates for construction and occupation program. The Client Representative may at his discretion instruct External Facade Contractor to undertake additional submissions whenever necessary.

幕墙承包商对本项目有管辖权的当局的送审须满足施工及用地规划的检查时间。如果必要，业主代表也可要求外幕墙承包商递交其他附加文件。

f. External Facade Contractor shall employ his own Registered Structural Engineer (RSE) registered in China to endorse all submissions prior to submitting to Main Contractor.

外幕墙承包商须自聘有中国注册结构工程师（RSE），全面审核其提交给总包的所有送审文件。

1.02 SCOPE OF WORK 工作范围

A. The External Facade Contractor shall include all management, labor, insurances, contract guaranties, materials, tools, equipment, and services required to manufacture, assemble, deliver (including all import/export documents), courier, printing, reproduction of shop drawings and install all items necessary for the proper execution and completion of said items of work, as shown on the contract documents, the drawings, as specified herein, and/or as required by job conditions to provide a complete installation.
外幕墙承包商应提供所有管理、人工、保险、合同担保、材料、机具、设备以及制造、组装、交货（包含进出口文件）、快递、复印及施工图的复制等各项服务，正确执行安装及完成本工程。除应符合技术规格说明书、合约文件及图面上所示要求外，亦需配合实际工作的需要，提供完整的服务。

B. All work in this section shall comply with the requirements of the contract, including general and special conditions, along with the drawings and all other contract documents.
本工程所有工作均须符合合约中所有要求，包含一般和特殊工况下的工作，遵循图纸以及所有其他合约文件。

C. Design, handle, deliver and install External Facade Systems and associated works as shown on the architectural drawings or as otherwise specified and in accordance with the requirements of the contract documents.
除特别说明外，幕墙系统的设计、运送、交货、安装及建筑图所示的相关工作，必须符合合约文件的要求。

D. The work shall include, but is not limited to the following:
本工程的工程范围内容如下，但不只限于下列工程：

1. Shop drawings, engineering calculations, erection drawings, samples, test reports and conformance testing as required, duly endorsed by a Registered Structural Engineer (RSE) registered in China. Curtain Wall thermal calculation shall be reviwed and confirmed by the HVAC Engineer registered in China.

   图纸、计算书、加工图、样品、实验报告和要求进行的各项试验，需要由中国注册结构工程师(RSE)及时签署认可。幕墙热工计算应由中国注册的HVAC工程师审核确认。

2. Statutory approval and consent from Suzhou, China.

   中国苏州市法定机关送审。

3. All necessary tests required related to work.

   所有与本工程相关的测试。

4. The curtain wall system for tower façade, tower base, lobby, storefronts at podium, skylight, grill at crown, glass wall for the observation duck, glass wall and metal mess screen wall for TMD cladding wall, etc, as shown in the drawings.

   如建筑图所示的塔楼、塔楼基座、大堂、裙楼店面房、采光顶、塔冠格珊、观光平台玻璃幕墙及阻尼器包覆玻璃及金属网幕墙等所有幕墙系统。

5. Formed aluminum and panels, shadow box panels, closures, coping, caps, infill panels, gutters, parapet returns, soffits, column cladding, beam cladding, corner panels, ornamental fins, grilles, louvers and all miscellaneous trim items in conjunction with the exterior façade wall.

   折弯铝板、背衬箱板、收边板、盖板、端板、填入板、水沟、女儿墙包板、吊顶、柱包板、梁包板、转角板块、装饰翼、格栅、百叶及其它与幕墙相关的组件。

6. Aluminum, stainless steel and glazed shop front.

   铝型材，不锈钢及玻璃店面

7. Glass and glazing in conjunction with the work in this section.

   本节中包括的玻璃及密封等相关工作。

8. External metal ceilings and aluminum shading device.

   外部金属天花板，铝遮阳

9. Interface with the coordination of all Exterior Wall Maintenance and Interior Facade Cleaning System details.

外墙维护和室内表面清洁系统节点协调的交接面。

10. Integration of internal ceiling, design features and details that have an impact on the curtain wall.

影响到幕墙的室内吊顶、装饰设计及其他节点的交接面整合设计。

11. Interface with and Coordination of all exterior wall integral display lighting system details.

协调并整合与幕墙交接的照明系统节点。

12. Provision of thermal breaks/ thermal isolator.

设置断热条/隔热垫

13. Coordination and installation of BMU tie back by External Facade Contractor.

由外幕墙承包商负责擦窗机牵制扣的协调和安装。

14. Doors : *(See doors schedule and specification)*

门：（详见门表及其技术要求）

Entry doors and hardware at lobby floors and store fronts as shown on drawings.

如图纸所示，大堂层和店面房的入口门及其五金。

15. Painted aluminum panel at shadow box (glass spandrel) as shown in drawings.

如图纸所示，背衬箱（玻璃窗间墙）处的烤漆铝背板。

16. Condensation test at shadow box shall be done in the laboratory.

背衬箱的结露测试应在实验室中进行。

17. Anchors, brackets, and clips attaching materials specified in this section to structure, including cutting of slab edge screen as may be required to accomplish anchorage.

本节所指的与结构体连接的锚件、托架及扣件，包括可能需要切割楼板边缘来安装转接件。

18. Cast-in concrete inserts and embeds installation and design including all setting diagrams and layouts as required for placement into the form work (formwork by others).

预埋铁件、安装、设计包含设置图和平面布置图（模板工作由其他承包商承接）。

19. All necessary steel or aluminum members, including intermediate anchors (kicker braces) required to support, strengthen, or stiffen wall-framing members including areas where no concrete wall support is provided.

提供所有必需的铁构件及铝构件，包含无混凝土支撑墙处承托墙体的框架构件的支撑、加强及补强的构件。

20. Construction and testing of aluminum curtain wall performance mock-ups at independent testing laboratory, selected by the Design Architect and Façade Consultant, including all coordination of testing. Testing procedures with laboratory, including laboratory fees, provision for one, as shown in attachment “A”. The External Façade Contractor shall fulfill the local city laboratory requirement, to design and perform the minimum test locally if required, in addition to performance mock up as specified in Architectural drawing.
在设计建筑师及幕墙顾问选定的独立实验室里进行的性能测试模型的建造及测试，包含如建筑图中所示的实验相关的所有协调工作、实验室测试步骤、包括测试费用、模型的准备等。如有需要，外幕墙承包商须按当地实验室要求进行设计和测试中所述的性能试验以外的当地要求的试验。

21. Construction of aluminum and glass curtain wall benchmark for workmanship shall be two (2) weeks before proceeding to mass production. Provide one prototype for each wall type in the Contractor manufacturer’s shop and onother one in the jobsite at the location to be selected by the Client Representative, including all construction coordination and provision of supporting structure where required
建造用来检验工艺标准的铝型材和玻璃幕墙的工地工厂实际安装样板，应在大量生产之前的两（2）个星期进行。在分包商的工厂里为每一种墙型提供一个工地工厂实际安装样板，并且在工地由业主代表指定的区域安装另一个工地工厂实际安装样板。包括所有相关的施工协调及所需区域的支撑结构。

22. Sealants, closed cell (non gassing) backer rods, vents, weeps, weep tubes, weep retainers, gutters, end dams, etc., as shown or as necessary within the system, and to join the system to adjacent construction.

如已经标明或系统需要的，与本工程及相邻工程相关的密封胶、不透气背衬泡棉、透气孔、排水孔、排水管、排水孔泡棉押条、水沟、收口板。

23. Attachment points, reinforcements, lightning protection, aviation lights, BMU track, etc., penetrations and seals for external and internal mounted light fixtures and signage supports within external facade wall scope.

室内/外灯具及招牌的固定点、补强、避雷针、航空灯、擦窗机轨道等工作所需要的穿透部位及其防水密封工作是包括在幕墙承包范围内的。

24. Field tests for resistance to water leakage.

工地现场淋水测试。

25. Spandrel insulation at non-vision areas, and at areas shown in drawings.

如图纸所示区域的非可视区的窗间墙保温棉。

26. Fire stops, fire safing, continuous metal safing support members, support clips for safing at slabs behind cladding systems and vertically where

required and smoke stop or seal and metal closure angles at each floor level. *(Shall be coordinated with Firestopping Contractor of the Building).*

每一楼层幕墙与楼板间以及竖向需要设置防烟封堵和密封处的防火隔断、防火棉、支撑防火棉的连续金属构件、防火棉支撑扣。*（须跟消防承包商协调配合）*

27. External canopies excluding main steel structure *(System type to be advised by the DesignArchitect).*

    外雨棚，不包括主钢结构。*（雨棚的形式须得到设计建筑师的确认）*

28. Entrance doors including revolving door and swing doors.

    入口门包括旋转门及平推门。

29. Expansion joints concealed with metal cladding.

    使用金属板封闭的伸缩缝

30. External façade-related structures such as :

    外幕墙相关的结构，例如:

    a. Typical steel support of curtain wall at upper and lower floors.
       楼层间顶底幕墙钢结构支撑
    b. Structural steel system for entrance canopy (by main contractor).
       入口雨棚钢结构系统（由总包负责）

31. The facade contractor is responsible to coordinate the installation of signage, lighting, blinds, and shades including the incorporation of internal wiring, components provided by others, into the faade system as may be required including the cutting and sealing of holes for wiring pathways.

    幕墙承包商负责协调外部照明、广告标识及窗帘及百叶遮阳帘的安装，并在幕墙系统中整合室内布线及构件（其他单位提供），包括走线的开洞及密封。

32. Coordination with other trades including but not limited to the following:

    与其他工程的协调，但不仅限于下列工程：

    a. Signage/Graphics.
       标志牌/招牌
    b. Superstructure Frame. Particular attention should be paid to the provision of fixing lugs on the superstructure steel frame which will pick up secondary steelwork provided within the curtain wall contracts.

       主体结构框架。应特别注意在主体结构钢框架上设置的用于固定幕墙的二次结构固定连接件。

    c. Miscellaneous :
       其他
       1) Iron (Steel)

钢构

2) Ductwork Canopies
雨蓬的排水管
3) Aviation Lights and External Facade Lighting
航空指示灯和外幕墙上的灯具
4) Ornamental Metals such as handrails, guardrails, and grilles.
装饰金属，例如扶手、栏杆和格栅。
5) Sheet metal
金属薄板
6) Ductwork
管道系统
7) Plumbing (Drains)
下水（排水沟）
8) Lighting fixtures.
灯具
9) Water and electrical outlets.
水电接头
10) Lightning protection.
避雷
11) Exterior maintenance equipment
室外维护设备
12) Telecommunications equipment.
通信设备
13) Security
安全

33. Fire services.
消防防火
34. Protection, removal, and final cleaning of finished work,
保护、移除及竣工后的清理工作。

1.03 RELATED WORK SPECIFIED ELSEWHERE AND SPECIFICALLY EXCLUDED 相关但不包含的工作

A. Interior decorative metal work other than an integral part of the work of this section or specifically called for above.
室内装修工程除非规范特别说明或与本工程相关需整合的工作

1.04 REFERENCES 规范及标准

All standards and regulations/Code of Practices referenced herein; unless otherwise specified, the current revisions of standards are applicable. The External Facade

Contractor shall have copies of the following standards, regulations/Code of Practices available for discussion during on-going work.
除特别指定外，本技术规格说明书所采用的标准及法规必须为最新修订版本。外幕墙承包商于必须拥有下列的标准和规范.

A. PRC Codes & Standards

China Curtain Wall Manual, Current Edition.
中国幕墙工程技术规范应用手册

GB/T 700	Carbon Structural Steel 碳素结构钢
GB/T 706	Hot rolled section steel 热辊型钢
GB/T 710	Hot-rolled quality carbon structural steel sheets and strips 优质碳素结构钢热轧薄钢板和钢带
GB/T 716	Cold-rolled carbon structural steel strips 碳素结构钢冷轧钢带
GB/T 912	Hot-rolled Plain Carbon and Low Alloy Structural Steel Sheets and Strips 碳素结构钢和低合金结构钢热轧薄钢板及钢带
GB/T 1220	Stainless Steel Bars 不锈钢棒
GB/T 1591	High strength low alloy structural steels 低合金高强度结构钢
GB/T 2518	Continuous hot-dip zinc-coated steel sheets and strips 连续热镀锌钢板及钢带
GB 3098.6	Fastener mechanical properties of stainless steel bolts, screws, stud 紧固件机械性能不锈钢螺栓、螺钉、螺柱
GB/T 3191	Extrusion rods and bars of aluminum and aluminum alloy 铝及铝合金挤压棒材
GB/T 3194	Wrought aluminum and aluminum alloy sheets and strips--Tolerances on forms and dimensions 铝及铝合金板、带材的尺寸允许偏差
GB/T 3274	Hot-rolled plates and strips of carbon structural steels and high strength low alloy structural steels 碳素结构钢和低合金结构钢热轧厚钢板和钢带
GB/T 3280	Cold rolled stainless steel plate, sheet and strip

	不锈钢冷轧钢板和钢带
GB/T 3524	Hot-rolled carbon and low alloy structural steel strips 碳素结构钢和低合金结构钢热轧钢带
GB/T 4226	Cold finished stainless steel bars 不锈钢冷加工钢棒
GB/T 4237	Hot rolled stainless steel plate, sheet and strip 不锈钢热轧钢板
GB/T 4437.1	Aluminum and aluminum alloy extruded tubes--Part 1: Seamless tubes 铝及铝合金热挤压管第一部分:无缝圆管
GB 5237.1	Wrought aluminum alloy extruded profiles for architecture - Part 1: Mill finish profiles 铝合金建筑型材第 1 部分：基材
GB 5237.2	Wrought aluminum alloy extruded profiles for architecture - Part 2: Anodized profiles 铝合金建筑型材第 2 部分：阳极氧化型材
GB 5237.4	Wrought aluminum alloy extruded profiles for architecture - Part 4：Powder coating profiles 铝合金建筑型材第 4 部分：粉末喷涂型材
GB 5237.5	Wrought aluminum alloy extruded profiles for architecture - Part 5: PVDF coating profiles 铝合金建筑型材第 5 部分：氟碳喷涂型材
GB/T 5267.3	Fasteners - Hot dip galvanized coatings 紧固件：热浸镀锌
GB/T 5464	Non-combustibility test method of building materials 建筑材料不燃性试验方法
GB/T 6725	Cold forming steel sections 冷弯型钢
GB/T 8013	Anodizing of Aluminum and Aluminum Alloys – General Specifications for Anodic Oxidation Coatings. 铝及铝合金阳极氧化,阳极氧化膜总规定
GB/T 8014.1	Anodizing of aluminum and its alloys-The measuring method of thickness of anodic oxide coatings Part 1:The measuring principle. 铝及铝合金阳极氧化,阳极氧化膜厚度的定义和有关测量厚度的规定
GB/T 8015.1	Test methods for thickness of anodic oxidation coatings on aluminum and aluminum alloys--Gravimetric method.

	铝及铝合金阳极氧化膜厚度的试验的方法
GB/T 8162	Seamless steel tubes for structural purposes 建筑用无缝钢管
GB/T 8165	Stainless steel clad plates, sheets and strips 不锈钢复合板
GB/T 8478	Aluminum windows and doors 铝合金门窗
GB 8624	Classification for burning behavior for building materials and products 建筑材料燃烧性能分级方法
GB/T 8626	Test method of flammability for building materials 建筑材料可燃性试验方法
GB 9962	Laminated glass 夹层玻璃
GB/T 9963	Tempered glass 钢化玻璃
GB/T 9978	Fire resistance tests--Elements of building construction 建筑构件耐火试验方法
GB/T 10294	Thermal insulation--Determination of steady-state thermal resistance and related properties - Guarded hot plate apparatus 绝热材料稳态热阻及有关特性的测定防护热板法
GB 11614	Float Glass 浮法玻璃
GB / T 11944	Sealed Insulating Glass Unit 中空玻璃
GB/T 13477.1	Test method for building sealants--Part 1: Specifications for test substrates 建筑密封材料试验方法第 1 部分:
GB/T 13477.18	Test method for building sealants--Part 18: Determination of adhesion-in-peel 建筑密封材料试验方法第 18 部分:剥离粘结性的测定
GB/T 14683	Silicone sealant for building 硅酮建筑密封胶
GB/T 14978	Continual hot-dip aluminum zinc silicon alloy coated steel strips and sheets 连续热浸镀铝锌硅合金镀层钢带和钢板
GB/T15228	Test Method of Water Penetration Performance for Building Curtain Walls.

	建筑幕墙雨水渗漏性能检测方法
GB 15763.1	Safety glazing materials in building -Fire-resistant glass 建筑用安全玻璃防火玻璃
GB 15763.2	Safety glazing materials in building-Part 2: Tempered glass 建筑用安全玻璃第 2 部分：钢化玻璃
GB/T 15764	Standard definitions of terms relating to flat glass 平板玻璃术语
GB 16776	Structural silicone sealants for building 建筑用硅酮结构密封胶
GB 16807	Fire intumescent seals 防火膨胀密封件
GB 17841	Tempered and heat-strengthened glass used in curtain wall 幕墙用钢化玻璃与半钢化玻璃
GB/T 18915.1	Coated glass--Part 1: Solar control coated glass 镀膜玻璃第 1 部分:阳光控制镀膜玻璃
GB/T 18915.2	Coated glass--Part 2: Low emissivity coated glass 镀膜玻璃第 2 部分:低辐射镀膜玻璃
GB 19154	Permanently installed suspended access equipment 擦窗机
GB/T 19805	Qualification test of welding operators 焊接操作工技能评定
GB/T 22086	Recommendations for welding of aluminum and aluminum alloys. 铝及铝合金焊接工艺
GB 50009	Structural load norms 建筑结构荷载规范
GB 50011	Seismic Design of Buildings 建筑抗震设计规范
GB 50016	Architectural design fire safety norms 建筑设计防火规范
GB 50045	Code for Fire Protection Design of Tall Buildings. 高层民用建筑设计防火规范
GB 50189	Public buildings energy-saving design standards 公共建筑节能设计标准
JC 486	Sealant for Insulated Glass 中空玻璃弹性密封胶
JGJ 102	Glass Curtain wall Specification

	玻璃幕墙工程技术规范
JGJ/T 151	Calculation specification for thermal performance of windows, doors and glass curtain walls 建筑门窗玻璃幕墙热工计算规程
GB21086	Curtain Wall for building 建筑幕墙
JGJ 113	Technical specification fro application of architectural glass 建筑玻璃应用技术规程
JGJ133	Techinncal code for metal and stone curtain walls engineering 金属与石材幕墙工程技术规范
JGJ255	Technical specification for skylight and metal roof 采光顶与金属屋面技术规程
JGJ257	Technical specification for cable structures 索结构技术规程
JGJ134	Design Standard for Energy Efficiency of Residential building in Hot Summer and Cold Winter Zone 夏热冬冷地区居住建筑节能设计标准
GB50176	Thermal Design code for civil building 民用建筑热工设计规范

B. AMERICAN STANDARDS:

1. ALUMINUM ASSOCIATION (AA)

AA DM-105	(2005; Errata 2005) Aluminum Design Manual
AA ASD1	(2009) Aluminum Standards and Data (Customary U.S. Units)
AA DAF-45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

2. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 501	2005: Methods of Test for Exterior Walls
AAMA 501.1	2005: Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure

AAMA 501.2	2009: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
AAMA 501.4 / 501.6	(2009) Recommended Static Test Method for Evaluating Curtain Wall and Storefront System Subjected to Seismic and Wind Induced Interstory Drifts & Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System
AAMA 501.2	2003: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, And Sloped Glazing Systems
AAMA 501.5	Test Method for Thermal Cycling of Exterior Walls
AAMA 502	1990: Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.
AAMA 503	2003: Voluntary Specification For Field Testing Of Storefronts, Curtain Walls And Sloped Glazing Systems
AAMA 507	2007: Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings.
AAMA 609 & 610	(2009) Cleaning and Maintenance Guide for Architecturally Finish Aluminum
AAMA 611	1998: Voluntary Specification for Anodized Architectural Aluminum
AAMA 800	2010: Voluntary Specifications and Test Methods for Sealants
AAMA 1503	98 (2004) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed
AAMA 2603	2002: Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
AAMA 2604	2002: Voluntary Specification, Performance Requirements and Test Procedures for High Performance Pigmented Organic Coatings on Aluminum Extrusions and Panels
AAMA 2605	2005: Voluntary Specification, Performance Requirements and Test Procedures for Superior

	Performing Organic Coatings on Aluminum Extrusions and Panels
AAMA CW-10	2004: Care and Handling of Architectural Aluminum from Shop to Site
AAMA CW-11	1985: Curtain Wall Manual # 11 - Design Wind loads for Buildings and Boundary Layer Wind Tunnel Testing
AAMA CW-DG-1	1996: Aluminum Curtain Wall Design Guide Manual
AAMA/WDMA/CSA 101/I.S.2/A440	(2008; Update 1& 2- 2008; 3 at 2009) North American Fenestration Standard/Specification for Windows, Doors, and Skylights
AAMA MCWM-1	1989: Metal Curtain Wall Manual
AAMA SFM -1	1987: Aluminum Store Front and Entrance Manual - AAMA Technical Reference Manual - Volume III (AAMA-III)
AAMA TIR A9	2000: Metal Curtain Wall Fasteners.
AAMA TIR-A11	2004: Maximum Allowable Deflection of Framing Systems for Building Cladding Components at Design Wind Loads

3. AMERICAN CONCRETE INSTITUTE (ACI) :

ACI 318	2008: Building Code Requirements for Structural Concrete and Commentary (Includes Errata)

4. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) :

ANSI Z97.1	2004: Safety Glazing Materials used in Buildings - Safety Performance Specifications and Methods of Test
ANSI A 250.4	2000: Test: Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
ANSI A 250.5	1994: Accelerated Physical Endurance Test Procedure for Steel Doors, Frames, and Frame Anchors
ANSI A156.18	2006: Specifications for Materials and Finishes

5. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) / AMERICAN IRON AND STEEL INSTITUTE (AISI):

AISC 325	2005: Steel Construction Manual, Thirteenth Edition
AISC/AISI 121	(2004) Standard Definitions for Use in the Design of Steel Structures
AISI SG03-3	(2008) Cold Formed Steel Design Manual Set

6. AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE):

ASCE 7-10	2010: Minimum Design Loads for Buildings and Other Structures

7. INTERNATIONAL CODE COUNCIL (ICC):

IBC	2006: International Building Code

8. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM) :

ASTM A 36/A 36M	2008: Standard Specification for Carbon Structural Steel
A463/A463M	2006: Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 167	(2009) Standard Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip
ASTM A618/A618M	2004: Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 653/A 653M	2008: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A666	2003: Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
ASTM A 780	2009: Standard Practice for Repair of Damage and Uncoated Areas of Hot- Dip Galvnize Coatings.

ASTM A792/A792M	2008: Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A1008/A1008M	2008: Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	2010: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B 209/B 209M	2007: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B211M	2003: Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire [Metric]
ASTM B 221	2008: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM C295	2008: Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C 661	2006: Indentation Hardness of Elastomeric Type Sealant by means of Durometer
ASTM C 719	2005: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealant under Cyclic Movement (Hockman Cycle)
ASTM C 792	2008: Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealant
ASTM C 509	2006: Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
ASTM C 794	2006: Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM C864	2005: Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting
ASTM C920	2005: Standard Specification for Elastomeric Joint Sealants
ASTM C 1036	2006: Standard Specification for Flat Glass
ASTM C1048	2004: Standard Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM C 1087	(00)2006: Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
ASTM C1172	2003: Standard Specification for Laminated Architectural Glass.
ASTM C1184	2005: Standard Specification for Structural Silicone Sealants
ASTM C1199	2000: Standard Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods
ASTM C 1253	(93) 2005: Standard Test Method for Determining the Outgassing Potential of Sealant Backing.
ASTM C 1376	2003: Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass
ASTM C1401	2007: Standard Guide for Structural Sealant Glazing
ASTM D 2200	2008: Pictorial Surface Preparation Standard for Painting Steel Surface.
ASTM D 2224	1983: Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	2002: Standard Practice for Testing Water Resistance Coating in 100% Relative Humidity.
ASTM D 2794	2004: Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
ASTM D 412	2006ae2: Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
ASTM C1464	2006: Standard Specification for Bent Glass
ASTM E 84	2008a: Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 119	2008a: Fire Tests of Building Construction and Materials

ASTM E 136	2004: Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 283	2004: Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 330	2010: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 331	2009: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure
ASTM F 476	Standard Test Methods for Security of Swinging Door Assemblies
ASTM E 773	2001: Standard Test Method for Accelerated Weathering of Sealed Units.
ASTM E1105	00(2008): Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
ASTM E1300	2007e1: Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E 1399	Cyclic Movement and Measuring the Minimum and Maximum Joint width of Architectural Joint Systems
ASTM E 1966	Standard Test Method for Fire-Resistive Joint Systems
ASTM E2307	Fire Tests of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-Story Test Apparatus
ASTM E2393	Standard Practice for On Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

9. AMERICAN WELDING SOCIETY (AWS) :

AWS D1.1/D1.1M (2010): Structural Welding Code – Steel

AWS D1.2/D1.2M (2003): Structural Welding Code - Aluminum.

10. GLASS ASSOCIATION OF NORTH AMERICA (GANA) :

GANA Glazing Manual, 2004 Edition

11. IEE (THE INSTITUTION OF ELECTRICAL ENGINEERS):

IEE Regulations: 16th Edition

12. INSULATING GLASS CERTIFICATION COUNCIL (IGCC) :

IGCC – Insulating Glass Certification Council

13. NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM) :

NAAMM AMP 500 2006: Metal Finishes Manual

14. NATIONAL BUILDING GRANITE QUARRIES ASSOCIATION (NBGQA) :

National Building Granite Quarries Association (NBGQA), Specifications for Architectural Granite.

15. MARBLE INSTITUTE OF AMERICA (MIA) :

Marble Institute of America (Marble Design Manual.)

16. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) :

OSHA STD1-3.3 revised on November 12, 1985 – Building Anchors used for Intermittent Stabilization of a Suspended Powered Platform in Window Washing Operations and light Building Maintenance.

17. PRESTRESSED CONCRETE INSTITUTE (PCI) :

PCI MNL-120 2004: PCI Design Handbook - Precast and Prestressed Concrete, 6th Edition

18. THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6 or NACE 3 Commercial Blast Cleaning

19. U.S. GENERAL SERVICES ADMINISTRATION (GSA) :

GSA FS DD-G-451d Glass, Float or Plate, Sheet, Figured (Flat, for Glazing, Mirrors

GSA FS DD-G- 1403c Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered).

20. U.S. Consumer Products Safety Commission (CPSC)

16 CFR 1201 Safety Standard for Architectural Glazing Materials

21. ASHRAE – American Society of Heating, Refrigerating, and Air-conditioning Engineers, INC.

ASHRAE 90.1: Energy Standard for Building except Low Rise Residential Building Require U - Factor and Solar Heat Gain and Specify NFRC for Compliance

22. NFRC – NATIONAL FENESTRATION RATING COUNCIL

NFRC 100: 2004 Procedure for Determining Fenestration Product U-Factor

NFRC 200: 2004 Procedure for Determining Fenestration Product Solar Heat Gain

NFRC 300: 2001 Procedure for Determining Solar Optical Properties of Simple Fenestration Products.

NFRC 400: 2001 Procedure for Determining Fenestration Product Air Leakage

23. Underwriters Laboratories (UL) of Northbrook, IL

Fire Resistive Directory

UL Qualified Firestop Contractor Program

24. National Fire Protection Association (NFPA) of Quincy, MA

NFPA 101 Approval of Firestop Contractors

C. Special References.

特别参考资料

Uniform Building Code (UBC)

BOCA National Building Code, Current Edition

AS 1288 – Australian Standard – Glass in Buildings (glass mullions only).

D. Notes:

注意

1. The External Facade Contractor shall be responsible in ensuring that all work are carried out in accordance with the requirements of theBuilding Authority and in complete compliance with the other Codes, Standards and Regulations referred to within this Specification.

   外幕墙承包商有责任确保本工程的工作满足建筑部门的要求，同时也满足本规范中列明的规范，规程和规定。

2. No substitution for the above codes shall be accepted without the endorsement from the Client Representative.

   如果没有业主代表的许可，不能替换上述规范。

3. If any conflict occurs among standards, specifications and requirements of statutory bodies and governmental departments, the most stringent shall take precedence.

   如果在上述规范、技术说明和政府部门的要求中出现任何冲突，以较为严格的规范为依据。

1.05 SYSTEM DESCRIPTION 系统概述

A. Wall types:
墙型：

Wall Type A: unitized curtain wall system for tower façade at office level, outer lite lamainted IGU for vision and spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Thermal broken extrusion with PVDF for exterior and Powder coating for interior finish.
墙型A：塔楼办公楼层单元式幕墙，在幕墙可视区及窗间墙区域采用外片夹胶的中空夹胶玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。断热型材在室外采用氟碳喷涂，在室内采用粉末喷涂。

Wall Type A-1: stick type curtain wall system for tower façade at office level 2 & 3, outer lite lamainted IGU for vision and spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Thermal broken extrusion with PVDF for exterior and Powder coating for interior finish.
墙型A-1：塔楼办公楼2&3层构件式幕墙，在幕墙可视区及窗间墙区域采用外片夹胶的中空夹胶玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。断热型材在室外采用氟碳喷涂，在室内采用粉末喷涂。

Wall Type B: unitized curtain wall system for tower façade area at Hotel levels, outer lite lamainted DGU for vision and outer lite lamainted IGU for spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Thermal broken extrusion with PVDF for exterior and Powder coating for interior finish.
墙型B：塔楼酒店楼层部位单元式幕墙，在幕墙可视，采用外片夹胶的双中空夹胶玻璃，窗间墙区域采用外片夹胶的中空夹胶玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。断热型材在室外采用氟碳喷涂，在室内采用粉末喷涂。

Wall Type C: unitized curtain wall system for tower façade area at Service Apartment levels, outer lite lamainted DGU for vision and outer lite lamainted IGU for spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Thermal broken extrusion with PVDF for exterior and Powder coating for interior finish.
墙型C：塔楼公寓楼层部位单元式幕墙，在幕墙可视，采用外片夹胶的双中空夹胶玻璃，窗间墙区域采用外片夹胶的中空夹胶玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。断热型材在室外采用氟碳喷涂，在室内采用粉末喷涂。

Wall Type D: unitized curtain wall system for tower façade area at mechanical levels, outer lite lamainted IGU for vision and spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Thermal broken extrusion with PVDF for exterior and Powder coating for interior finish.
墙型D：塔楼机电层部位单元式幕墙，在幕墙可视区及窗间墙区域采用外片夹胶的中空夹胶玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。断热型材在室外采用氟碳喷涂，在室内采用粉末喷涂。

Wall Type E: unitized curtain wall system installs on the steel plate structure which using tension rod to take the dead load for tower façade area at double height Sky Lobby levels, outer lite lamainted DGU for vision and outer lite lamainted IGU for spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Thermal broken extrusion with PVDF for exterior and Powder coating for interior finish.
墙型E：双层挑高塔楼公寓楼层部位单元式幕墙安装水平不锈钢板肋上，钢板肋采用竖向吊杆承受自重。在幕墙可视，采用外片夹胶的双中空夹胶玻璃，窗间墙区域采用外片夹胶的中空夹胶玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。断热型材在室外采用氟碳喷涂，在室内采用粉末喷涂。

Wall Type F:

墙型F：

F1：frameless Glass system for Lobby wall
F1:大堂无肋玻璃幕墙系统。

F2: frameless Glass system for Lobby wall at Entrance.
F2：在大堂入口处的无肋玻璃幕墙系统。

F3: stick type system portal frame for Lobby wall at Entrance, laminated glass is adopted for the elevation and roof for the portal. Galvanized steel tube mullion with stainless teel mullion cladding.
F3：在大堂入口处的门斗构件式系统。在立面和顶面采用夹胶玻璃。镀锌钢框架外包不锈钢包板。

F4: Stick type system for lobby at east elevation, double height façade laminated glass for spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Galvanized steel tube mullion with aluminum mullion cladding.
F4：东立面首层大堂部位构件式幕墙，在幕墙窗间墙区域采用夹胶玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。镀锌钢龙骨外包铝板包板。

Wall Type G: Stick type system for tower crown lobby, double height and triple height façade Double laminated IGU for vision and spandrel area, painted aluminum panel with semi-rigid insulation at shadow box at spandrel area. Galvanized steel tube mullion with Stainless steel mullion cladding.
墙型G：塔冠大堂部位构件式幕墙，在幕墙可视区及窗间墙区域采用双夹胶中空玻璃，窗间墙背衬箱部位采用喷涂铝板及中硬度保温棉。镀锌梯形钢龙骨外包不锈钢包板。

Wall Type H:

墙型H：

H1: stick type system storefront at sunken garden, IGU for vision and spandrel area, Thermal broken extrusion with PVDF for exterior and Powder coating for interior finish. Aluminum soffit at exterior
H1: 下沉广场店面橱窗构件式幕墙。在可视区和窗间墙区域采用中空玻璃。断热型材在室外表面采用氟碳喷涂，在室内表面采用粉末喷涂。室外铝板吊顶。

H2: stick type system at the solid wall at the parameter of the sunken garden, igu glass with aluminum shadow box back panel apply on this façade. PVDF for exterior and Powder coating for interior finish.
H2: 下沉广场周边实体墙采用构件式系统。采用中空玻璃和铝板背衬箱。室外采用氟碳喷涂，室内采用粉末喷涂。

H3: Granite Stone at the staircase wall. Using galvanized steel mullion with G.I sheet backpan.
H3: 楼梯侧墙采用花岗岩。镀锌钢龙骨及镀锌背板。

B. All system shall be designed that damaged exterior materials can be replaced; such as glass and Metal panels from the exterior.
所有系统应设计为可以更换室外受损材料，例如：从室外更换玻璃和不锈钢板。

C. Unitized and Semi-unitized wall systems as indicated on drawings, glass and glazing, aluminum panels, operable windows, louvers and all required trim. The unitized system to be open joint with pressure equalized cavities behind the panels with two distinct lines of defense and drainage.

如图纸所示的单元式及半单元式幕墙系统，玻璃及镶嵌，铝板，开启扇，百叶及装饰线条。单元式系统采用开放式节点的等压腔系统，并设置两道防水线及排水。

D. Provide movable joints to accommodate the full range of thermal and building movement/displacement, manufacturing and erection tolerances, floor creep, beam creep, column settlement, inter-story differential and movement, in accordance with the design requirements.
设置可移动接缝以便吸收热膨胀及建筑位移/形变、加工和吊装误差、楼层徐变、梁徐变、柱的缩短、层间位移等设计要求。

1.06 ATTIC STOCK 备料

Upon completion of construction, deliver to a designated storage area specified by the owner, spare materials for maintenance and repair. Materials shall conform to the same requirements as materials used for construction. Delivery should be completed within three months after the commencement of Defects and Liability Period (DLP).
外幕墙承包商须于本工程完成时，提交备份的材料给予业主，以便于日后维修的使用，备份材料的品质须与本工程的材料品质一致。供货应在质保期(DLP) 开始后三个月内完成。

A. Provide glass in the following sizes and quantities.
玻璃的数量及尺寸

1. one (1) percent of job quantity glass (not less than 2 pieces) of each type of insulated glass unit with standard size.

   1%标准尺寸每种类型的中空玻璃的数量。(每种玻璃不得少于二片)

B. Provide horizontal covers, and trim in the following lengths and quantities.
水平盖板及饰条的长度及数量

1. Ten (10) stock lengths of each type of trim.

   水平盖板及饰条，每种盖板及饰条十支，其长度为库存长度(Stock Length)

C. Provide vertical trim covers in the following lengths and quantities.
垂直盖板的长度及数量

1. Ten (10) longest exterior glazing channels.

   室外玻璃镶嵌槽，每种嵌槽十支，其长度为最长尺寸。

2. Ten (10) longest size aluminum interior-trim covers, each type.

   室内饰条，每种饰条十支，其长度为最长尺寸。

D. Stainless Steelpanel : provide 2% as stock (but not less than 2 pieces)
不锈钢板：按 2%提供备料（但不少于 2 块）

E. Aluminum louver: provide 2% as stock (but not less than 2 pieces)
铝百叶：按 2%提供备料（但不少于 2 块）

F. Provide hardware for doors and operable windows.
提供门和开启窗的五金

1. 5% of door hardware and accessories.

   5%的门五金及配件

2. 5% of operable window hardware and accessories.

   5%的开启扇五金及配件

Note: Extrusion dies should be made available to the owner for spare parts for a period not to be less than the warranty period.
注：用于备料的型材的模具应在质保期内为业主保存

1.07 PERFORMANCE AND TESTING REQUIREMENTS 功能要求及测试规定

The following structural, weather resistance and performance requirements shall be met or exceeded by the as-built work. Performance and conformance to codes and standards shall be demonstrated by calculations, mock-ups and field-testing.
完工幕墙的结构性及耐候性必须符合或优于下列的要求，并且以计算数据、性能试验及工地现场测试验证。

A. Structural Properties
结构特性

1. Design Wind Loads
设计风荷载

a. Design wind loads for the External Façade Systems shall follow Wind Tunnel Test, s*ee Attachment A.*

所有设计风荷载以风洞试验为依据。详见附件*[A]*

b. Corner areas shall be, at a minimum, analyzed under the following wind load conditions.

根据下列风荷载工况提供转角区域的结构分析：

1) Both sides loaded with 100% positive load.

二边(AB两边)均承受100%的正风压荷载。

2) Both sides loaded with 100% negative load.

二边(AB两边)均承受100%的负风压荷载。

3) Side "A" loaded with 100% positive load and side "B" without load.

一边(A边)承受100%的正风压荷载，另一边(B边)则未承受任何风压荷载。

4) Side "B" loaded with 100% positive load and side "A" without load.

一边(B边)承受100%的正风压荷载，另一边(A边)则未承受任何风压荷载。

5) Side "A" loaded with 100% negative load and side "B" without load.

一边(A边)承受100%的负风压荷载，另一边(B边)则未承受任何风压荷载。

6) Side "B" loaded with 100% negative load and side "A" without load.

一边(B边)承受100%的负风压荷载，另一边(A边)则未承受任何风压荷载。

7) Other loading combinations may be required by code or other special job conditions.

根据规范或其他特殊工况的需要进行其他荷载组合。

2. Special Loads
特殊荷载

a. Parapets and Balustrades shall be loaded not less than the following:

女儿墙及栏杆的承载力不得小于：

1) 50 lb/ft (0.73 kN/m) uniformly distributed load applied in any direction at the top and transferred through the supports in the structure, in accordance with ASCE7 4.4.1.

顶端任意方向大小为 50 lb/ft (0.73 kN/m)均布荷载，并且荷载通过支撑传到主体结构，应符合 ASCE7 4.4.1

2) 200 lbs (0.89 kN) concentrated load applied in any direction along the top and transferred through the supports in the structure, in accordance with ASCE7 4.4.1.

顶端为 200 lbs (0.89 kN) 的集中荷载，并且荷载通过支撑传到主体结构，应符合 ASCE7 4.4.1

3) Uniform and concentrated loads in items 1 and 2 are not assumed to act concurrently.

前两项所述均布和集中荷载假设不会同时作用。

4) 50 lbs (0.22 kN) applied in an area of 1ft (305mm) square for intermediate rail except the handrail, in accordance with ASCE7 4.4.1.

除了扶手之外栏杆中部 1ft (305mm)区域受力：50 lbs (0.22 kN)，应符合 ASCE7 4.4.1

5) For glass used as structural balustrade and railings, the panel and support system shall be designed with a safety factor of four (4) considering the loads on items 1, 2 and 4, in accordance with 2006 IBC 2407.1.1.

以上第 1、2、4 项中，如果玻璃作为受力栏杆和扶手，板块和支撑系统的受力应该为 4 倍承载力考虑，应符合 2006IBC 2407.1.1.

6) Parapets and balustrades shall be designed to withstand applicable wind loads as stated in this specification.

女儿墙及栏杆，必须能承受本技术说明中写明的适用的风荷载。

7) Parapet support and projecting cornices or sills to withstand loads imposed by the Building Maintenance Unit (BMU)

weight and operation.

女儿墙支撑及其它外突物，必须能承受擦窗机的自重及操作时产生的力量。

3. Seismic Load
地震荷载

a. Design seismic forces shall be in accordance with the latest edition of ASCE7 and Chinese Code for Seismic Design of Buildings (GB50011), whichever is more stringent.

设计引用地震力应根据ASCE7及中国建筑抗震规范最新版本(GB50011)选取。

4. Snow Load
地震荷载

a. Design snow loads shall be in accordance with the latest edition of GB 50009.

设计雪荷载应该根据国标 GB 50009确定。

5. Deflection Limitations
挠度限制

a. The deflection of framing members for building cladding components in a direction normal to the plane of the wall when subjected to the specified design load shall be limited to the following:

在指定设计压力及载重下，任一框架构件的挠曲位移在垂直于墙面的方向上不得超过：

1) 1/180of the framing member clear-span for spans up to 4.110m; in accordance with AAMA-TIR-A11，JGJ102 current edition, JGJ102 and GB 21086.

跨度小于4.5m的骨架构件，挠度限制为净跨度的1/180。应符合现行版AAMA-TIR-A11,JGJ102和GB21086的要求。

2) 30 of the framing member clear-span for a span greater than 4.5m but not exceeding 12.00m; in accordance with AAMA-TIR-A11，JGJ102 and GB21086 current edition.

跨度大于4.5m但不超过12.00m的骨架构件，挠度限制为30mm。应符合现行版AAMA-TIR-A11，JGJ102及GB21086的要求。

3) 1/175 of the glass edge length or 19mm whichever is less, for the included framing members along the glass edge of individual glass pane; in accordance with AAMA-TIR-A11 current edition. The 19mm limit shall not apply to the overall span of the member supporting multiple lites.

骨架构件沿着独立玻璃板块边缘方向状态下，玻璃边长度的1/175 或者 19mm 其中小的一个。应符合现行版

AAMA-TIR-A11的要求。19mm的限制不适用于构件支撑多个板块的总跨度。

4) 1/250 of the steel framing member clear-span for steel used in supporting building cladding components and frames; in accordance with ANSI/AISC 360 Chapter L Section L3 and JGJ102 & GB21086's requirement.The deflection limits discussed in items 1 and 2 shall still be satisfied when steel is used as primary framing for building cladding components.

支撑外覆板配件及其框架的钢骨架构件净跨度的1/250。应符合现行版ANSI/AISC 360的L章L3节中的要求，以及JGJ102和GB21086的要求。当钢架作为建筑覆板的主支撑结构时第1、 2项条件同样须满足。

5) 1/360 of the framing member clear-span for skylights members with attached plaster ceiling; in accordance with 2006 IBC Table 1604.3.

当采光顶带有附加石膏板吊顶层时，骨架结构净跨度的1/360。应符合现行版2006 IBC 表1604.3.中的要求。

6) 1/240 of the framing member clear-span for skylight members supporting non-plaster ceiling; in accordance with 2006 IBC Table 1604.3.

当采光顶支撑非石膏板吊顶层时，骨架结构净跨度的1/240。应符合现行版2006 IBC 表1604.3.中的要求。

7) 1/180 of the framing members clear span for skylight members not supporting ceiling; in accordance with 2006 IBC Table 1604.3.

当采光顶的构件不支撑吊顶层时，骨架结构净跨度的1/180。应符合现行版2006 IBC 表1604.3.中的要求。

8) 1/240 of the framing member clear-span for framing members with brittle finishes or dry walls are attached; in accordance with 2006 IBC Table 1604.3.

当骨架构件带有易碎的表面或有石膏板墙附着时，骨架结构净跨度的1/240。应符合现行版2006 IBC 表1604.3.中的要求。

9) 1/120 of the framing member clear-span for framing members with flexible finishes; in accordance with 2006 IBC Table 1604.3.

当骨架构件带有柔性的表面时，骨架结构净跨度的1/120。应符合现行版2006 IBC 表1604.3.中的要求。

10) An amount, in such a way that the stone cladding being supported shall not exceed a relative deflection of 1/600 of the least dimension of stone cladding.

石材幕墙的支撑点应不超过石材最大尺寸的1/600.

11) 50% of the nominal joint width at sealant joints occurring between framing members and relatively stiff building elements, or less if required by the sealant manufacturer.

当幕墙骨架与刚性较大的建筑结构体之间含有接缝时，则骨架的挠曲位移置不得大于接缝宽度的50％；若硅酮密封胶制造商容许的挠曲位移较小时，则应依硅酮密封胶制造厂的要求。

12) Allowable deflection at service loads for tensioned cables, L/50 of the tensioned cables unsupported span, where L is the shorter span.

拉索的允许挠度是在正常荷载作用下不超过拉索跨度L的1/50，L取值较小跨度

Note:
注：

a) For cantilever framing members, the span shall be taken as two (2) times the distance between anchor centerline and end of cantilever.

如为悬臂，其净跨应取自固定支座的中心线至悬臂末端距离的二倍。

b) The movement or deflection of the framing members shall not cause disengagement of the snap covers or trim nor shall impair the function or damage any of the seals.

框架构件的位移和偏转不能导致扣板或装饰条的脱离和变形，且不会影响或损坏任何硅酮胶。

b. The deflection of framing members for building cladding components in a direction parallel to the wall when subjected to the design load shall be limited to:

在指定的设计压力及荷载作用下，任一框架构件包含转角竖料在平行于墙面的方向上，其挠曲变形量不得超过：

1) 3mm over a fixed panel or glass and 1.5mm over an opening window or door when subjected to full dead load; in accordance with AAMA-SFM-1-87 Article 5.5.1.

恒荷载作用下，固定板块或玻璃为3㎜，开启扇和门为1.5㎜。应符合现行版AAMA-SFM-1-87 第5.5.1.章节中的要求。

2) An amount, which will reduce the glass bite below 75% of the design dimension and shall not cause disengagement of snap covers or trim and shall not impair the function or damage any of the seals.

会使玻璃的咬合减少至设计尺寸的75％的挠曲位移；不能使扣板，装饰条脱落的且不会影响或损坏任何密封剂的挠曲位移。

3) 10mm due to wind load or shall be designed in such a way that it shall not cause disengagement of snap covers or trim and shall not impair the function or damage any of the seals.

在风荷载作用下为10mm，或被设计为不导致扣板装饰条脱落并不会影响或损坏任何密封剂的挠曲位移。

c. Uniform load structural tests of the work shall be conducted in accordance with ASTM E330. Inward and outward acting test pressures for Structural Safety Test shall be equal to 1.5 times the inward and outward acting design wind loads. Satisfactory performance at these loads shall mean.

依照 ASTM E330 进行本工程的均布荷载结构测试，正负风压的试验压力应等于正负风压设计压力的 1.5 倍，在此载重下合格的效能包括：

No permanent deformation of main framing members in excess of 0.2% of their clear span.

主要框架构件上不能出现其跨度 0.2%的永久变形。

d. At connection points of framing members to anchors, combined movements of anchor relative to building structure, and framing member relative to anchor, shall not exceed 1.5mm in any direction, nor 1.5mm residual deflection after load is removed.

在框架和锚件的连接点处，框架相对于锚件和锚件相对于建筑结构的总位移，任何方向上均不得超过1.5mm。当移除荷载的后，其永久变型不得超过1.5mm。

e. Upon reversal of load direction at magnitudes up to and including 1.5 times design pressures, slippage at fastened and/or clamped connections shall not exceed 3mm.

负风压的作用力为设计压力的1.5倍时，固定扣件的滑动量不得超过3.0mm。

f. The deflection of each edge of the glass shall be limited to 1/180 of the glass length under consideration or 19mm, whichever is less; in accordance with ASTM E 1300 (latest edition) and AAMA-TIR-A11-1996 and GB21086.

玻璃每条边的挠曲位移量不应超过玻璃长度的1/180或19mm，以较小者为依据。应符合ASTM E 1300（现行版）和AAMA-TIR-A11-1996 和GB21086的要求。.

g. Center of glass deflection load shall not exceed L/60 of the smaller span.

玻璃中心挠度应不大于较小跨度的L/60

h. Tension cable deflection load shall range at L/45 of the shorter span.

拉索挠度荷载应控制在较小跨度的L/50

i. Metal panel deflection shall not exceed 1/120 of the span, in accordance with 2006 IBC Table 1604.3 Footnote h or 19mm, whichever is less. The span shall be taken as the lesser of the distances between the horizontal, or the vertical support members.

金属面板的挠曲位移量不得超过其跨距的l/120或19 mm，以较小者为依据。应符合2006IBC 表1604.3注脚h中要求。跨度取水平或垂直支撑构件的中跨度较小者。

j. Perforated metal panel deflection shall not exceed the limits of deflection stated in Item h.

穿孔金属面板的挠曲位移量不得超过上述h条款中的限值。

6. Structural Design Criteria and Testing Requirements.
结构设计准则及测试要求

a. The work shall be designed to withstand the design loads specified herein. Compliance shall be demonstrated by calculations performed in accordance with accepted engineering practice, codes and standards.

工程的设计应能承受本文所指定的设计荷载及压力，并以符合工程惯例的计算验证。

b. Uniform load structural tests of the work shall be conducted in accordance with ASTM E330&GBT15227. Inward and outward acting test pressures for Structural Safety Test shall be equal to 1.5 times the inward and outward acting design wind loads. Satisfactory performance at these loads shall mean the following:

依照ASTM E330&GBT15227进行本工程的均布荷载结构测试，正负风压的试验压力应等于正负风压设计压力的1.5倍，在此载重下合格的效能包括：

1) No glass breakage

玻璃未破损

2) No permanent damage to fasteners or anchors, hardware parts or actuating mechanisms

固定铁件、锚钉、五金零件及传动装置无永久性的损坏

3) No malfunctioning of windows, doors, and operating hardware

窗、门及活动构件无故障

c. When components are designed using strength design, load factors and load combinations shall be in accordance with ASCE7 Chapter 2 Section 2.3 and GB50009&JGJ102. In no case that here shall be allowable increase in strength when using strength design.

构件设计中的强度设计、荷载系数和荷载组合都应按照ASCE 7第二章2.3节和GB50009&JGJ102中要求取值。任何情况下强度计算取值不能超过屈服强度。

d. When using the load combinations considering either allowable stress design or strength design according to ASCE7 Chapter 2, the effects of one or more loads not acting shall be investigated. The one with the most unfavorable effects shall be considered.
荷载组合应同时考虑屈服强度和强度计算，应按照ASCE 7第二章2.3节中要求，一个或多个应力应充分考虑，并计算最不利荷载工况。

e. The allowable stresses that shall be considered in the structural calculation shall be in accordance with Chapter 3.4 of the Aluminum Design Manual by the Aluminum Association, Inc. The allowable compressive stress used in the design of flexural members shall take into account for the unbraced length of the compression flange. Glass, sealant, and interior finishes shall be assumed not to contribute to lateral stability of the framing members. Points of contra-flexure shall not be considered as lateral braces or as the end points of an unbraced length.
在结构计算中所考虑到的允许应力应与Aluminum Association, Inc.的铝材设计手册3.4章中的相符。在设计受弯构件时，容许压应力应考虑受压翼缘的无支撑长度。玻璃、密封胶和内部装饰对龙骨构件横向稳定性不起作用。反弯点不能考虑为横向支撑或无支撑长度的端点.

f. Insert or cast in anchors shall be designed with an overload factor (OLF) of 1.33. The OLF is in addition to load factors specified in any codes (i.e., the 1.4E, 1.4D and 1.3W load factors stated in the ASCE7 Chapter 2 and ACI-318 Chapter 9). However, if the design standard already includes an OLF for connection (i.e., the OLF of 1.33 specified in the PCI Handbook Chapter 6), the OLF for connections shall be the greater of 1.33 or the OLF for connections specified in the design standard. It applies to insert components including, but not limited to headed studs, deformed bars, insert plates, insert angles, and the concrete that the insert is embedded in. The factor for connections shall be applied to wind, seismic and gravity loads.
预埋件和后补埋件设计均应按1.33取过载系数。过载系数需在任何相关引用规范中合并计算（比如ASCE中第7章第2节的1.4E, 1.4D 和 1.3W荷载系数和ACI-318中第9章）。此外如果设计规范已经包括了连接过载系数（比如PCI手册第6章中特别指定的1.33过载系数）则连接过载系数应取1.33或设计规范中较大的一个。以上所说预埋构件包括但不限于双头螺栓、弯曲铁杆、预埋钢板、角码和有预埋件的混凝土。该系数适用于风荷载，重力荷载和地震荷载。

g. Glass fittings for tensioned cable wall must be designed to ensure maximum rotation of glass are accommodated to resist maximum actual concentrated glass edge stresses at point of supports.

拉索式幕墙的玻璃固定构件在设计时，必须考虑和保证在玻璃发生最大转动时，仍然能够在玻璃打孔处的边角集中应力强度范围内正常使用。

h. The contractor is responsible to ensure that main structure movements at the ends of the tensioned cables are accommodated.
承包商负责保证在拉索端头的主体结构发生位移时，拉索能够消化掉并保证正常工作

i. Tensioned cables contraction and expansion due to temperature loads must be considered by the tensioned cable wall system.
拉索幕墙设计需充分考虑到温度变化产生的温度应力使得拉索收缩或膨胀因素

j. Interfaces to rigid parts surrounding cable facade must be carefully designed and installed, with moving joints allowing low-warping deflection of moving cable facade parts while maintaining sufficient watertightness.
拉索幕墙与周围刚性幕墙的交界面必须精心设计并仔细安装，并配有允许轻微绕度的活动节点，同时保持不透水性。

k. The curtain wall should be designed according to the envelop structure design. The façade panel (glass and metal panel) should be checked based on the 50 years return period wind pressure for deflection and 100 years returen period wind pressure for stress. Other compontent should be designed acoording to 100 years returen period wind pressure.
幕墙应按围护结构进行承载能力极限状态和正常使用极限状态设计。本工程面板计算挠度时采用50 年一遇的风压，计算强度时采用100年一遇的风压，其他构件结构设计均采用100年一遇的风压。

B. Provision for Movement
位移

1. The External Facade Systems shall be designed to accommodate dead load and live load deflections, thermal expansion, creep, sway, and torsion of the building.

本工程于设计时，须防止建筑物因自重、活载、热膨胀、建筑物的震动及徐变所造成的位移。

2. Differential movement shall be accommodated in movable joints, and not slippage between adjacent materials (i.e. interlocking two-piece horizontal rails).

外墙的伸缩缝必须能吸收建筑物的位移，并且接缝边缘的材料不得产生滑动。(如2个水平扶手的互锁装置)

3. The amount of total movement that is accommodated in the External Facade Contractor’s design shall be identified on submittal drawings, and

shall be accompanied by calculations deriving total movements including thermal calculations.

外幕墙承包商设计中的总位移调节量应在送审图中明确，而且总位移应在相应的计算书中体现，计算书应包括热工计算。

4. The External Façade Systems shall accommodate all movements without causing buckling, stresses on glass, failure of glass, metal, or joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, crackling noise, whistling noise or other detrimental effects. There shall be no failure or gross permanent distortion of anchors, frames, glass or panels, no gasket disengagement and no weather or structural sealant failures.

   幕墙系统应能吸收各种位移且不会导致玻璃弯曲并承受应力、玻璃破坏、金属构件破坏、胶缝破坏、结构件非正常受力、螺栓连接件受破坏荷载、性能削弱、摩擦噪音、风哨音或其它不良状况。同时，不能使锚固件破坏或产生永久变形。

5. The External Façade Systems shall be designed to provide for such thermal expansion or contraction of component materials. There shall be no buckling, stresses on glass, failure of glass, metal, or joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance or other detrimental effects, as will be caused by the following temperature range:

   幕墙系统设计应充分考虑金属本身热胀冷缩造成的位移变化，而不会导致构件锁扣、玻璃承受应力、玻璃破坏、金属构件破坏、胶缝破坏、结构件非正常受力、螺栓连接件受破坏荷载、性能削弱或其它不良状况。以下为各部分的温度变化范围：

   a. Exterior air temperature range: -20 °C JGJ/T 151-2008

      室外空气温度范围：-20 °C JGJ/T 151-2008

   b. Metal surface temperature: 65 °C - for light colors
      82 °C - for dark colors

      金属表面温度： 65 °C – 浅色
      82 °C – 深色

   c. Interior temperature range: 20 °C JGJ/T 151-2008

      室内温度范围: 20 °C JGJ/T 151-2008

6. The External Facade System shall be designed to accommodate:
   本工程幕墙系统设计应能承受：

   a. Inter-story differential vertical movement of+/- 25 mm, to be accommodated by stack joint based on the following: *(Structural Engineer to provide)*
      垂直层间位移是+/- 25 mm, 基于以下条件通过水平接缝适应调节：

1) Deflection of slab/beam edge supporting the Curtain wall system due to dead load: +/- ____ mm *(Structural Engineer to provide)*

支撑幕墙的楼板/梁边缘在恒载作用下的挠曲mm

2) Deflection of slab/beam edge supporting the Curtain wall system due to dead load: +/- ____ mm *(Structural Engineer to provide)*

支撑幕墙的楼板/梁边缘在活载作用下的挠曲mm

3) Creep (vertical component on slab/beam edge supporting curtain wall for long term:_____ mm *(Structural Engineer to provide)*

支撑幕墙的楼板/梁边缘长期徐变mm

4) Column shortening (vertical component on slab/beam edge supporting curtain wall) for long term::_____ mm *(Structural Engineer to provide)*

长期柱子的收缩(在支撑幕墙的楼板/梁边缘的垂直构件)mm

5) External Façade Panel Tolerances:

外幕墙板块允许误差

a) Assembly : 1.0mm

组装：1.0mm

b) Component Fabrication :0.5mm

构件加工：0.5mm

c) Site Installation & Erection :1.5mm

现场安装及吊装：1.5mm

d) Framing Thermal Expansion :4.5mm

框架热膨胀：4.5mm

b. Inter-story differential vertical movement of+/- _____ mm, to be accommodated by anchor bracket system based on the following: *(Structural Engineer to provide)*
垂直层间位移+/- _____ mm，基于以下条件通过支座系统适应调节：

1) Deflection of slab/beam edge supporting the Curtain wall system due to dead load:_____ mm *(Structural Engineer to provide)*

支撑幕墙的楼板/梁边缘在恒载作用下的挠曲：_____ mm

2) Creep (vertical component on slab/beam edge supporting curtain wall for short term:_____ mm *(Structural Engineer to provide)*

支撑幕墙的楼板/梁边缘短期徐变：_____ mm

3) Column shortening (vertical component on slab / beam edge supporting curtain wall) for short term:_____ mm *(Structural Engineer to provide)*

短期柱子的收缩(在支撑幕墙的楼板/梁边缘的垂直构件)：_____ mm

4) Construction tolerance of slab / beam edge supporting the curtain wall vertically (up & down):N/A (Steel perimeter beam in Z15) *(Structural Engineer to provide)*

支撑幕墙的楼板/梁边缘上下方向施工误差：N/A (Z15钢圈梁)

c. Inter-story differential lateral movement of____mm, to be accommodated by Curtain Wall joints in any direction based on the following: *(Structural Engineer to provide)*
侧向层间位移____mm，基于以下条件通过各向幕墙接缝适应调节：

1) Inter-story drift due to wind load (horizontal component on slab/beam edge supporting curtain wall):____mm *(Structural Engineer to provide)*

由风荷载引起的层间偏移(在支撑幕墙的楼板/梁边缘的水平构件)：____mm

2) Inter-story drift due to seismic load (horizontal component on slab / beam edge supporting curtain wall):_____mm *(Structural Engineer to provide)*

由地震荷载引起的层间偏移(在支撑幕墙的楼板/梁边缘的水平构件)：_____mm

d. Inter-story differential lateral movement of+/- _____ mm, to be accommodated by anchor and bracket system based on the following: *(Structural Engineer to provide)*
侧向层间位移+/- _____ mm，基于以下条件通过各向支座和挂件适应调节：

1) Construction tolerance of slab / beam edge supporting the curtain wall laterally (in & out): N/A (Steel perimeter beam in Z15) *(Structural Engineer to provide)*
支撑幕墙的楼板/梁边缘进出方向施工误差：N/A (Z15钢圈梁)

Note:
注：

a. The External Facade Contractor shall confirm allowable movement with Structural Engineer of record according and in conformance to Suzhou Regulations.

外幕墙承包商应根据结构工程师的记录以及符合苏州市规定确认允许位移量

b. The External Facade Contractor shall confirm with Structural Engineer of record with regard to the above-listed items which deflections shall be summed up and items that are independent of others; in order to arrive with the design movement joint.

为了得到设计位移数据，外幕墙承包商应就上述列出的数据与结构工程师复核，哪些数据应进行叠加，哪些应独立于其他数据。

C. Air Leakage
气密性

1. Air infiltration test shall conform to ASTM E 283& GB21086.

本工程的空气泄漏率须符合ASTM E 283& GB21086的规定。

a. Air leakage of fixed wall area shall not exceed 0.06 cfm/ft^2 (0.0182 m^3/min/m^2) of exterior surface, exclusive of any operating window and door areas, with a pressure differential of 6.24 psf (300 Pa).
在6.24 psf (300 Pa)的气压差作用下，固定墙（不包含活动窗及门）的漏气率，不得超过外墙表面的0.0182 m3/min/m2（0.06cfm/ft^2）.

b. Air leakage of operating windows or doors shall not exceed 0.25 cfm/ft (0.0232 m^3/min/m) of crack length, with a pressure differential of 6.24psf (300Pa).
在6.24psf (300Pa)的气压差作用下，活动窗及门边缘的漏气率，不得超过0.0232 m^3/min/m（0.25 cfm/ft）.

c. The air leakage should not lower than level 4 as state in the GB21086, which the air leakage of fix wall area shall not exceed 0.2m^3/h/m^2 under 10pa as per GB code.
空气渗透率不应低于GB21086中的4级要求。空气渗透率不得超过0.2m^3/h/m^2.

D. Water Penetration
漏水

1. The occurrence of condensation during water infiltration tests is acceptable. The accumulation of water in doorsill tracks is acceptable; overflow, percolation or leakage of water from sill tracks is not acceptable. Other water leakage is acceptable only if all of the following conditions are satisfied:

在漏水测试时，若出现结露水是允许的；水积聚于门窗轨道内亦是可容许的，但不得由门窗轨溢出或渗漏。其它漏水则仅在满足以下的所有条件时才可容许：

a. The water shall be contained and fully drained to the exterior.

水未溢流，且可排至外部。

b. There shall be no wetting of a surface that would be visible to building occupants.

建筑物内侧可见表面未被沾湿。

c. There shall be no staining or no damage to any part of the completed building and its furnishings. This definition of water leakage shall govern over other definitions, which may appear in reference documents.

不会污损或破坏建筑物及其已装设完成的任何材料。该漏水定义效力大于其它参考文件上的定义。

d. The source of all water leakage during testing shall be identified and necessary remedial measures adaptable to job condition shall be made. Remedial measures that are not adaptable to job conditions are not acceptable.

所有测试中产生的漏水均需查明原因并提出相应有效的整改措施。

2. Provision shall be made to drain any water entering the system at joints, at glazing, through panels, and from condensation to the exterior face of the work. Drainage shall be provided at every floor.

本设计须提供排出来自接缝处、嵌条及经由结露而进入系统的外来水的排水构造，并应每层排水。

3. No uncontrolled water penetration shall occur when the work is tested in accordance with ASTM E 331, AAMA 501.1, ASTM E 1105 and/or AAMA 501.2 GB21086using definition of water leakage and test procedures as defined herein. The difference in static air pressure used in the test shall be 15 psf (720 Pa).

当本工程依ASTM E331、ASTM E1105、AAMA 501.1或AAMA 501.2 GB21086测试时，不可发生任何漏水现象。测试时所用的静压差应为720 Pa。

E. Environmental Design Conditions

环境设计条件

1. Outdoor Design Conditions. (Based on JGJ/T 151-2008 codes)

室外设计条件. (基于JGJ/T 151-2008规范)

a. Outside Air Temperature for Summer: [86]°F (30)°C DB

夏季室外平均温度：[86]°F (30)°C干球

b. Outside Air Temperature for Winter: [-4]°F (-20.0)°C DB

冬季室外平均温度：[-4]°F (-20.0)°C干球

c. Outside Air Velocity for Summer: [ ] mph (kph) *(Mechanical Engineer to provide)*

夏季室外空气速度：[ ] mph (kph)

d. Outside Air Velocity for Winter: [ ] mph (kph) *(Mechanical Engineer to provide)*

冬季室外空气速度：[ ] mph (kph)

2. Indoor Design Conditions:

   室内设计条件

   a. Inside Ambient Temperature: [77]°F (25°C) DB

      室内环境温度：[77]°F (25°C)干球

   b. Inside Controlled Relative Humidity: 50-60 % RH *(mechanical engineer to confirm)*
      室内控制相对湿度：45-50 %*(机电专业确认)*

F. Thermal Transmittance:
热透射率

1. Thermal transmittance calculations of the external façade are required to be provided by the External Façade Contractor. The wall types that shall be calculated for thermal transmittance shall be identified by the Design Architect and either MEP Consultant or Energy Consultant.

   外幕墙承包商应提供幕墙的热透射率计算。所有墙型均应进行热透射率计算并由设计建筑师及机电或节能顾问认可。

2. The External Facade Contractor shall confirm the thermal transmittance (U-Value) requirements of external façade assemblies according to and in conformance with local regulations or energy codes applicable to this project. The External Façade Contractor shall work with the Design Architect and Energy Consultant in conducting energy calculations or external façade design changes to demonstrate thermal transmittance compliance to the local regulations or applicable energy code.

   外幕墙承包商应确认外幕墙的热透射率(U-值)是根据并符合适用于本项目的当地标准和节能规范。幕墙承包商应配合建筑师及节能顾问提供备选的节能计算或外墙设计调整以证明热透射率符合当地标准或适用节能规范。

3. Thermal transmittance values of external façade assemblies shall be determined in accordance with testing procedures of AAMA 1503 or ASTM C 1363. It is also accepted if thermal transmittance is determined using computer simulation according to NFRC 100, NFRC CMA, AAMA 507, and JGJ151 or approved local thermal transmittance engineering codes and standards.

   外幕墙个构件的热透射数值应由AAMA 1503或ASTM C 1363测试程序决定。根据NFRC 100， NFRC CMA， AAMA 507，and JGJ151或认可的当地热工节能规范及标准进行计算机模拟得到的热透射率也是可以接受的。

   a. Computer simulation for thermal performance shall use the latest approved version of THERM, WINDOW, or CMAST programs or equivalent.

      热工性能计算机模拟需要使用认可的最新版THERM及WINDOW软件或类似软件。

b. The glazing assembly thermal transmittance shall include the effect of frames unless the approved thermal transmittance engineering codes and standards specifically states that it is excluded.

除非在认可的当地节能规范标准热透射率章节有特别规定，否则可视区玻璃单元的组件的热工计算应包含幕墙龙骨的影响。

c. Opaque panel assemblies and spandrel panel thermal transmittance shall include the effect of frames unless the approved thermal transmittance engineering codes and standards specifically states that it is excluded.

除非在认可的当地节能规范标准热透射率章节有特别规定，否则不透光板块的组件和窗间墙板块热工计算应包幕墙龙骨的影响。

G. Solar Heat Gain Coefficient and Visible Light Transmittance:
阳光得热系数及可见光透过率

1. Shading Coefficient (SC), Solar Heat Gain Coefficient (SHGC), Visible Transmittance (VT) or Visible Light transmittance (VLT) shall be determined according to NFRC 200 or other approved engineering codes and standards.

遮阳系数(SC)，阳光得热系数(SHGC)，透视率(VT)或可见光透射率(VLT)应根据NFRC 200或经认可的节能规范及标准确定。

2. Glass optical/spectral data shall be determined according to NFRC 300 or other approved engineering codes and standards.

玻璃的光学/光谱数据应根据NFRC 300或经认可的节能规范及标准确定。

H. Condensation Control: Design, fabricate and install the exterior wall to prevent excessive condensation on the face with the building heating and ventilation system in the normal operation under the following conditions shall be verified by the mechanical engineer of record. Excessive condensation is defined as visible water on more than 5% of the area of any module of the interior face of exterior wall, or the accumulation of uncontrolled condensation flowing from the interior wall at any location OR the exterior wall including glass and metal framing shall have a condensation resistance factor of net less than 35 when tested based on AAMA 1503 and JGJ151.

结露控制：在以下的由机械工程师验证得出的几种正常运行的建筑暖通系统情况下，应设计、加工及安装外墙使之能防止在其表面产生过多的结露。过多的结露将定义为：在任何模数的外墙的内表面上有超过5% 的区域存在可见水滴；或者：聚积的水滴在内墙表面任意流动。当根据AAMA1503和 JGJ151测试时，外墙包括其玻璃和金属框架需有一个小于.35的结露抗性因子。

1. The outdoor and indoor environmental conditions shall be in accordance with Article 1.07 Paragraph E of this specification.

室内外环境条件应对照技术规格说明1.07E条款。

2. The Condensation Resistance Factor (CRF) of the wall components surfaces shall be computed in accordance with Section 5.4.1 of AAMA 1503.

幕墙防结露因子应参照AAMA 1503.的5.4.1计算。

3. The performance shall be demonstrated by testing method as per AAMA 1503 OR by computer modeling through FRAME or THERM simulation program or equivalent, if carried out for all components based on Section 5.0 and 5.1 of AAMA 507 and JGJ151.

此性能将由测试方法AAMA1053和计算机模拟程序FRAME或THERM（该模拟程序应采用AAMA507 and JGJ151中5.0及5.1章节中的构件数据）验证得出。

I. Shadow Boxes: Design, fabricate and install shadow box assemblies so that they do not exhibit condensation, deformation or de-lamination of the interior metal surfaces. Provide positive drainage weeps of the air space to the dry interior so that there are no accumulations of moisture.

背衬箱：设计、加工及安装背衬箱，使之不会结露、变形或出现内部的金属表面处理脱落的现象。设置通往龙骨干腔的单向排水孔，以避免水蒸气聚集。

J. Glass Performance Requirements
玻璃性能要求

1. GL-01: *Laminated IGU* - Tower façade at office level: Vision glass
8mm HS Low-Iron + 1.52mm PVB + 8mm HS Low-Iron （Low-E coating on #4） + 12mm A warm edge black + 10mm Low-Iron FT，
GL-01: 夹胶中空玻璃-塔楼办公楼层大面:可视玻璃
8mm 超白半钢化玻璃 + 1.52mm PVB + 8mm 超白半钢化玻璃（ Low-E 镀膜在第四表面 + 12mm 空气层暖边黑色间隔条 + 10mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.50

2. GL-02: *Laminated IGU* - Tower façade at office M.E. level: Vision glass
8mm HS Low-Iron + 1.52mm PVB + 8mm HS Low-Iron （Low-E coating on #4） + 12mm A warm edge black+ 12mm Low-Iron FT，
GL-02: 夹胶中空玻璃-塔楼办公机电层大面:可视玻璃
8mm 超白半钢化玻璃 + 1.52mm PVB + 8mm 超白半钢化玻璃（ Low-E 镀膜在第四表面 + 12mm 空气层暖边黑色间隔条+ 12mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC	≤0. 35	U Value – W/(M² º K)	≤1.50

得热系数		传热系数（U 值 W/㎡ K）	

3. **GL-03: *Laminated IGU*** - Tower façade at Apartment Level: Vision glass
8mm HS Low-Iron + 1.52mm PVB + 8mm HS Low-Iron （Low-E coating on #4） + 12mm A warm edge black + 8mm Low-Iron FT+ 12mm A + 10mm Low-Iron FT，
GL-03: 夹胶中空玻璃-塔楼公寓层大面:可视玻璃
8mm 超白半钢化玻璃 + 1.52mm PVB + 8mm 超白半钢化玻璃（ Low-E 镀膜在第四表面 + 12mm 空气层暖边黑色间隔条 + 8mm 超白钢化玻璃+ 12mm A + 10mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.23

4. **GL-03X: *Laminated IGU*** - Tower façade at Apartment Level at Large Piece at Corner: Vision glass
8mm HS Low-Iron + 1.52mm SGP + 8mm HS Low-Iron （Low-E coating on #4） + 12mm A warm edge black + 8mm Low-Iron FT+ 12mm A + 12mm Low-Iron FT，
GL-03X: 夹胶中空玻璃-塔楼公寓层转角特大板块:可视玻璃
8mm 超白半钢化玻璃 + 1.52mm SGP + 8mm 超白半钢化玻璃（ Low-E 镀膜在第四表面 + 12mm 空气层暖边黑色间隔条 + 8mm 超白钢化玻璃+ 12mm A + 12mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.23

5. **GL-04: Laminated *IGU*** - Tower façade at Crown Lobby:
10mm Low-Iron + 1.52mm SGP + 10mm Clear （Low-E coating on #4） + 12mm A + 10mm Low-Iron + 1.52mm SGP + 10mm Low-Iron HS

GL-04: 夹胶中空玻璃-塔冠大堂：
10mm 超白玻璃 + 1.52mm SGP+ 10mm 超白玻璃（ Low-E镀膜在第四表面 + 12mm 空气层暖边黑色间隔条 + 10mm 超白玻璃 + 1.52mm SGP+ 10mm 超白半钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC	≤0. 35	U Value – W/(M² º K)	≤1.80

得热系数		传热系数（U 值 W/㎡ K）	

6. **GL-05: Laminated *IGU*** - Tower façade at Skylights:
8mm Low-Iron （Low-E coating on #2） + 12mm A + 6mm Low-Iron + 1.52mm PVB + 6mm Low-Iron FT

GL-05: 夹胶中空玻璃-塔冠采光顶：
8mm 超白玻璃（Low-E镀膜在第二表面）+ 12mm A + 6mm 超白玻璃 + 1.52mm PVB+ 6mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0.27	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.80

7. **GL-06: Laminated – *Gurardrail Glass***
10mm Low-Iron + 1.52mm SGP + 10mm Low-Iron Fully Tempered Laminated Glass
GL-06:夹胶玻璃 –玻璃栏板
10mm 超白+ 1.52mm SGP + 10mm 超白钢化夹胶玻璃

8. **GL-11: multilayer Laminated Glass** - Tower façade at Lobby:
8*12mm SGP interlayer Laminated Low-Iron Glass with coating on #x
GL-11: 夹胶中空玻璃-塔楼首层大堂：
8 x 12mm SGP胶片超白钢化夹胶玻璃，第x表面镀反射膜

9. **GL-12: Laminated –*Canopy***
6mm HS Low-Iron + 1.52mm PVB + 6mm HS Low-Iron + 1.52mm PVB + 6mm HS Low-Iron Fully Tempered Laminated Glass with Frit on #2and #4, Partern refer to architecture's requirement
GL-12:夹胶玻璃 –雨篷
6mm 超白+ 1.52mm PVB + 6mm + 1.52mm PVB + 6mm超白钢化夹胶玻璃,在第2表面和第4表面有彩釉，图案参考建筑师的要求。

10. **GL-13: Laminated –*Entrance frameless glass facade @ lobby***
12mm Low-Iron + 1.52mm SGP + 12mm Low-Iron+ 1.52mm SGP + 12mm Low-Iron+ 1.52mm SGP + 12mm Low-Iron Fully Tempered Laminated Glass
GL-13:夹胶玻璃 –入口无肋幕墙@大堂
12mm + 1.52mm SGP + 12mm+ 1.52mm SGP + 12mm+ 1.52mm SGP + 12mm 超白钢化夹胶玻璃

11. **GL-14: Laminated** – Door Glass
10mm Low-Iron + 1.52mm PVB + 10mm Low-Iron Fully Tempered Laminated Glass

GL-14:夹胶玻璃 –门玻璃
10mm 超白+ 1.52mm PVB + 10mm 超白钢化夹胶玻璃，

12. **GL-15: *IGU*** – Door Glass
8mm Low-Iron （Low-E coating on #2） + 12mm A + 8mm Low-Iron FT
GL-15:中空玻璃-门玻璃
8mm 超白玻璃（ Low-E镀膜在第二表面 + 12mm A + 8mm 超白钢化玻璃，

13. **GL-21: *IGU*** – 下沉广场
10mm Clear （Low-E coating on #2） + 12mm A + 10mm Low-Iron FT
GL-21:中空玻璃-门玻璃
10mm 超白玻璃（Low-E镀膜在第二表面 + 12mm A + 10mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0.35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.50

14. **GL-22: Laminated – *Gurardrail Glass***
8mm Low-Iron + 1.52mm PVB + 8mm Low-Iron Fully Tempered Laminated Glass
GL-22:夹胶玻璃 –玻璃栏板
8mm 超白+ 1.52mm PVB + 8mm 超白夹胶钢化玻璃

15. **GL-S1: Laminated *IGU*** - Tower façade at SA level: Spandrel glass
8mm Low-Iron + 1.52mm PVB + 8mm Low-Iron（Low-E coating on #4）+ 12mm A warm edge black + 8mm Low-Iron FT
GL-01S: 夹胶中空玻璃-塔楼公寓楼层大面：窗间墙玻璃
8mm 超白半钢化玻璃 + 1.52mm PVB + 8mm 超白半钢化玻璃（ Low-E镀膜在第四表面 + 12mm 空气层暖边黑色间隔条 + 8mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.50

16. **GL-S2: Laminated *IGU*** - Tower façade at office level: Spandrel glass
8mm Low-Iron + 1.52mm PVB + 8mm Low-Iron（Low-E coating on #4）+ 12mm A warm edge black + 10mm Low-Iron FT
GL-S2: 夹胶中空玻璃-塔楼办公楼层大面：窗间墙玻璃

8mm 超白半钢化玻璃 + 1.52mm PVB + 8mm 超白半钢化玻璃（ Low-E 镀膜在第四表面 + 12mm 空气层暖边黑色间隔条 + 10mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.50

17. GL-S3: Laminated *IGU* - Tower façade at office level: Spandrel glass
6mm Low-Iron + 1.52mm PVB + 6mm Clear （Low-E coating on #4） + 12mm A warm edge black + 8mm Low-Iron FT
GL-S3: 夹胶中空玻璃-塔楼办公楼层大面：窗间墙玻璃
6mm 超白半钢化玻璃 + 1.52mm PVB + 6mm 超白半钢化玻璃（ Low-E 镀膜在第四表面 + 12mm 空气层暖边黑色间隔条 + 8mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.50

18. GL-S4: IGU –*spandrel shadow box @ sunken garden*
6mm clear （Low-E coating on #2） + 12mm A + 6mm clear FT
GL-S4:中空玻璃 –窗间墙背衬@下沉广场
6mm玻璃（ Low-E镀膜在第二表面） + 12mm A + 6mm钢化玻璃

19. GL-F1: *IGU* - Tower façade at office level: Fire access window
12mm Low-Iorn （Low-E coating on #2） + 12mm A warm edge black + 12mm Low-Iron FT
GL-F1:中空玻璃-塔楼办公楼层大面：消防救援窗
12mm 超白玻璃（ Low-E镀膜在第二表面 + 12mm 空气层暖边黑色间隔条 + 12mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.50

20. GL-F2: *IGU* - Tower façade at Apartment Level: Vision glass
10mm Low-Iron （Low-E coating on #2） + 12mm A warm edge black + 10mm Low-Iron FT+ 12mm A + 10mm Low-Iron FT，
GL-F2:中空玻璃-塔楼公寓层大面:可视玻璃

10mm 超白玻璃（ Low-E镀膜在第二表面） + 12mm 空气层暖边黑色间隔条 + 10mm 超白钢化玻璃+ 12mm A + 10mm 超白钢化玻璃，

Light Transmittance 可见光透射比	≥0.45	Reflectance Visible Light-Exterior 可见光反射比（室外）	≤18%
SHGC 得热系数	≤0. 35	U Value – W/(M² º K) 传热系数（U 值 W/㎡ K）	≤1.50

K. Fire resistance requirements.
防火规定

1. Performance of panels under fire or high temperature exposure shall be in accordance with the procedures listed below:

   面板曝置于火或高温下，其效能须符合下列各项：

   Non-combustibility 不燃性: ASTM E 136& GB8624

   Flame-spread 火焰蔓延: ASTM E 84& GB8624

   Fire Resistive Rating 防火等级: ASTM E 119 or a modified ASTM E 119 procedure & GB8624

2. The spandrel panel including shadow box areas shall be designed and anchored in a manner that it will stay in place and prevent passage of smoke, flame, and hot gases for the requisite fire exposure period when exposed to the ASTM E 119 time temperature curve of 2 hours rating.

   窗间墙板块包括背衬箱区域应有良好的固定，且能符合ASTM E 119中时间─温度曲线的二小时防火时效的规定，防止烟、火焰及热气的穿透。

3. Fire rated fire safing and smoke seal assemblies shall be provided between the interior wall surface and the building structure. Locations to satisfy, as minimum, local authority and Buildings Department requirements and any additional requirements specified herein.

   建筑图所示的内墙面及建筑物楼板间应设置防火及安全隔热的层间塞及防烟密封胶，且须有两小时防火时效，至少符合地方政府建筑部门或其它相关的规定。

4. 1-hour fire rated solid barrier with a minimum high of 1500mm along the parameter of the building outside of the edge of slab.

   每层楼板外沿设置高度不低于 1500mm 的不燃烧实体裙墙并沿建筑物一周封闭成环，耐火极限不低于 1.0 小时

5. Use 200mm fire safing infill the gap between curtain wall and the slab and use 1.5mm G.I sheet support the insulation, the fire rate is not less than 1.5hours.

楼板与幕墙间采用 200mm 防火棉填实，外加 1.5mm 镀锌钢板支撑，耐火极限不低于 1.5 小时。

6. The thermal insulation used at the spandrel area should have a class A fire resistance.

   非透明幕墙部分的保温材料均采用 A 级不燃烧材料（岩棉）

1.08 SUBMITTALS 送审资料

A. Variances and Exceptions

差异及例外

Prior to submitting any documents or sample, the External Facade Contractor shall do the following

送审任何文件或样品的前，外幕墙承包商应提供:

1. Provide an itemized list of all requirements of the architectural drawings and the project specifications that are not embodied in the contract for work under this section. Each listed item shall be identified by the architectural drawing and detail number, or specification page and paragraph, whichever applicable.

   提供一份合约内未注明的建筑图纸和工程规范的需求名目清单，各项皆应注明其建筑图式及细目编号，或规格的页次及条目。

2. Provide a written statement of full compliance with the architectural drawings and specifications in the event there are no exceptions or deviations.

   如并无更改及差异，分包商应以书面说明其完全符合建筑图式及规范。

B. Proposal drawings
投标图纸

1. With his bid, the External Facade Contractor shall submit proposal drawings that address typical conditions for each type of work, typical curtain wall for each wall type, metal panel, ground floor cladding system, tension wall, and louvers. The proposal drawings shall include typical partial elevations (with anchor locations), sections (drawn full size), and anchorages (showing connections to structure). The proposal shall include structural calculations to substantiate the design. Proposal drawings are to show all adjacent construction and provisions for all items as noted in this specification Article 1.05 – System Description.

   外幕墙承包商应于投标时提交投标图纸，说明每种工作的典型情况、各典型幕墙墙型、金属板幕墙、首层幕墙系统、拉索幕墙及百叶。投标图纸包括标准层的局部立面图(包括预埋件位置图)、剖面图(完全尺寸图)、及锚点详图(展示与建筑结构的连接部)，同时应包含结构计算书。投标图纸应显示所有邻近工程及本规范1.05系统描述所述的各项规定。

C. Submittal Reviews and Approvals
送审资料的审核

1. All required documents/samples shall be completed and approved per the specification requirements.

   所有必要的文件和样品必须完整，且符合技术规格说明书的要求。

2. Costs related to the submission of shop drawings, calculations, and all other documentary submissions by courier to consultants in foreign countries (and retrieval) shall be borne by the External Facade Contractor. The External Facade Contractor should allow for a total of 12 sets of each document for each submission or as per the Architect's instruction.

   递交顾问公司的所有与图纸、计算书和其它送审文件有关的境外快递费用（包括收件）都应有外幕墙承包商负担。外幕墙承包商每次送审或按照建筑师指令应提供一式 [12] 份送审文件。

3. The External Facade Contractor shall submit documents to the Main Contractor for review and approval per the procedures identified in the Contract Documents.

   外幕墙承包商应提交送审文件给总承包商，以便其按合同要求的程序审核批复。

4. The External Facade Contractor shall ensure that all required submissions are included in the approved Construction Schedule to allow the Client Representative to review the shop drawings in a timely manner.

   外幕墙承包商应确保所有送审都包括在已经批复通过的施工计划中，以便业主代表能及时审核施工图。

5. If after one submission and one re-submission of any document/sample, the External Facade Contractor has not obtained the approval of the Client Representative/Architect the External Facade Contractor shall bear the costs and time of reviewing additional submissions.

   若经过初次、二次送审仍未通过顾问及业主代表审核时，则外幕墙承包商须承担顾问或业主代表重新审核的费用。

6. Documents that require the approval of the Client Representative include mock-up shop drawings and structural calculations, project shop drawings structural calculations, method statement, project quality plan and inspection and test plan (I.T.P.), project staffing list, Submittal Schedule, test proposals, test reports, third party/manufacturer's review and certificates/approvals letters, samples.

   需要送审供业主代表审核的文件包括：性能试验图纸和结构计算、工程施工图及结构计算、施工组织计划、质量管理计划、检查及测试计划(I.T.P.)、人员名单、送审进度、测试建议书、测试报告、第三方/制造商的审核报告、证明文件/批准信件、样品等。

D. Sequencing of Submittals
送审顺序

1. Prior to any submittal, the External Facade Contractor shall submit a detailed Submission Schedule including 1st and 2nd (follow-up, if required) submittal dates for each item/zone/package:

   外幕墙承包商于送审前，须先提送详细的送审进度计划表，包括第一次及第二次送审、日期、项目及区域：

   a. Project Quality Plan and Inspection and Test Plan (I.T.P.)

      质量管理计划、检查及测试计划。

   b. Project Staffing List with resumes of all personnel.

      人员名单及履历。

   c. Samples

      样品。

   d. Test Proposals and Test Reports

      测试计划及报告

   e. Manufacturer's Tests and Certificates/Approvals.

      制造商的审核报告、证明文件

   f. Drawings and documents for submission to Suzhou Buildings Department and local authorities.

      送交中国苏州当地建筑部门和其他主管部门的图纸和文件。

   g. Inserts or embed shop drawings and calculations.

      预埋件施工图及结构计算。

   h. Mock-up shop drawings and calculations.

      性能试验图及结构计算

   i. Project shop drawing and calculation packages broken down into logical and manageable zones including starter conditions, major wall areas, entrances and doors, canopies, roof areas and penthouse.

      细部施工图面及结构计算并加以分区，包含起始区、主要区域、入口、门、雨棚、屋顶区域及阁楼等。

   j. Registered Structural Engineer (RSE) checking and endorsement of drawings and calculations.

      图纸及计算书必须由中国注册工程师(RSE)审核及签署。

2. Project Quality Plan and Inspection and Test Plan (I.T.P.), Project Staffing List with resumes for all personnel shall be approved prior to the erection of the performance mock-up.

   应于性能试验安装前，通过质量管理计划、检查及测试计划、人员名单及履历的审核。

3. Mock-up shop drawings and calculations shall be approved prior to the erection of the performance mock-up.

应于性能试验安装前，通过模型施工图及结构计算的审核。

4. All samples, data sheets and manufacturer's tests/approvals/certificates relevant to the performance mock-up shall be submitted and approved prior to the erection of the performance mock-up. All other samples, data sheets and manufacturer's tests/approvals/certificates shall be submitted and approved prior to the erection of project works.

   任何与性能试验相关的所有样品、技术资料、制造商的审核报告及证明文件，必须于性能试验样板安装前送审及审核通过。其它所有样品、技术资料、制造商的审核报告及证明文件，必须于本工程安装前送审及被核准。

5. Project shop drawings and calculations shall incorporate all revisions required from the performance mock-up test and therefore shall not be submitted until after completion of the performance mock-up.

   工程实际施工图及结构计算必须根据性能试验结果修正。性能试验完成前，不得送审工程实际施工图及结构计算。

6. Prior to starting construction of any area of work, the External Facade Contractor shall submit complete shop drawings and calculations depicting all materials and work being furnished under his work. All shop drawings and submittals shall be subject to the Client Representative's approval.

   外幕墙承包商于工地开始安装的前，必须提供完整的工程实际施工图及结构计算，详细说明本工程所使用的材料。所有工程实际施工图及结构计算必须由业主代表及顾问审核通过。

7. Shop drawings shall not be submitted without complete corresponding structural calculations verifying adequacy of design. Calculations shall not be reviewed without corresponding shop drawings. Consultant review shall begin at the latest date of receipt of drawings or calculations, if they are not submitted simultaneously. The Design Architects may proceed with the review while waiting for the calculations submission.

   同一区域的施工图及结构计算必须同时送审，否则将不予审核。顾问将于同时收到施工图及结构计算时，才进行审核。若没有同时送达，顾问将在收到图纸或计算书的较晚的那一日期开始审核。设计建筑师可以在等待计算书提交的同时审核图纸。

E. Documents for submissions to local authorities.
政府建筑部门的送审

1. It is responsibility of External Facade Contractor to be aware of the statutory approval and consent periods for all submissions and shall ensure that all relevant drawings and documents or any part of the Subcontract Works are submitted well in advance for approval to government authorities and utility companies to meet staging of works.

   外幕墙承包商需清楚每一阶段送审日期，并须于每一阶段工作开始前，送审所有相关图及文件到政府建筑部门。

2. Drawings shall be provided as specified at same scale as for as-built drawings, or as specified by government authorities.

送审图纸的比例须与竣工图相同，或使用政府建筑部门格式。

3. Drawings for submission shall be forwarded to Main Contractor for review before submission.

   送审前，图纸必须先送交总包单位审核。

4. External Facade Contractor shall ensure that his submissions shall not delay subsequent inspection and testing procedures by Authorities concerned.

   外幕墙承包商必须确认图纸的送审不会耽误政府建筑部门的检验及测试。

5. External Facade Contractor shall make submissions to government authorities to meet inspection dates for construction and occupation program. The Client Representative may at his discretion instruct External Facade Contractor to undertake additional submissions whenever necessary.

   外幕墙承包商必须于政府建筑部门工程及使用许可检验前送审图纸，业主代表可随时要求分包商提供额外图纸，以符合政府建筑部门要求。

6. External Facade Contractor shall employ his own Registered Structural Engineer (RSE) approved by the Client Representative to endorse and design-check all submissions prior to submitting documents.

   外幕墙承包商必须雇用由业主代表认可的注册结构工程师(RSE)，在送审之前审核并签署所有的送审文件。

F. Shop drawings 施工图纸

1. Mock-up shop drawings shall include layout of test chamber steel showing simulated floor slab construction, beam connections and construction for movements test. Movement shall occur at intermediate floor level. Magnitude of movements provided shall be shown in details or indicated on drawings.

   施工图纸送审前，须先提送完整的性能试验图，包括模拟楼板的钢构件配置图及有位移时钢梁构件的固定及建造方式。位移须使用中间楼层的钢梁进行测试，并将位移的距离标示于图纸上。

2. Shop drawings shall include the following items:
   施工图纸必须包含下列各项：

   a. A cover sheet containing an index of drawings. Including drawing description, date, revision date and version.

      包括图纸目录的封面(图纸说明，原始完成日期，修正日期及修正版本)。

   b. A complete index of all materials (i.e. alloy, temper, thickness, finish, coating, size, profile, hardness, trade name, product name, manufacturer, etc.).

      所有材料的索引表(成色、韧度、厚度、尺寸、表面材质，涂层、外型、硬度、品牌、产品名称等)。

c. Plan layouts, showing insert and embed locations in relation to cladding and mullion centerline, and building column lines.

平面布局图，展示埋件的位置与幕墙、龙骨中心线和建筑结构柱中线的关系。

d. Floor plan layout for each different floor, showing all relevant geometric information, cladding layout and building column lines.

不同楼层的平面图必须包含外墙线及柱心线，及所有相关的几何形状尺寸。

e. Complete wall elevations and building sections at scale of 1:50, showing all relevant geometric information and fully color coded elevations to confirm the various paint colors.

1:50 比例的墙体立面图和建筑剖面图，展示所有相关的几何造型信息，使用不同色彩表示的立面来确认不同的喷涂颜色。

f. Typical unit or area elevation at scale of 1:20 both exterior and interior.

比例为 1：20 的室内外标准单元或局部立面图。

g. Full size details of every member, joint, connection, anchorage, joinery details with internal seals, welds, glazing details with glass and metal sizes and relationships, and sealant applications.

1:1 的全尺寸图纸应展示每一个构件、接缝、连接、挂码。细部节点应包括内部打胶、焊缝、玻璃与金属板的尺寸及相关尺寸信息。

h. Isometric joinery details and details of the four-way joints showing all seals, detailed assembly, and any other conditions as requested by the Client Representative.

按业主代表及建筑师要求,提供各种十字接头及接缝处节点详图,组装方案包括密封胶及固定方式以三维空间立体详图表示。

i. Work point of curtain wall, and cross-referenced.

幕墙的工作基准点及索引。

j. Glass face in relation to curtain wall.

玻璃表面与幕墙的相对位置关系。

k. Provide joinery detail of all rail intersections and aluminum connection, show all seal at intersection. Show all section thickness, frame lap over glass and edge clearance.

所有接头的防水密封详图须标示所有断面厚度、玻璃与框架搭接长度与边缘的净距离。

l. Type, size and minimum length of all welds shall be fully identified.

标示所有焊接的形式、尺寸及最小长度。

m. All drawings shall be cross-referenced to each other.

所有图纸必须能相互索引查询。

n. All details shown in the shop drawings shall be uniform with the details and sketches shown in the structural calculations.

图纸上的节点图必须与计算书上的节点图或示意图相符合。

o. All drawings shall show adjacent work, terminations and flashings, structure, mechanical ducts and most importantly Phase II trades possibly by others including Canopies, Gutters, Storefronts, etc., structures and other trades requiring coordination.

所有图纸必须显示邻近工程、端板及批水、结构体、通风口、及其它主要相关工程包含雨蓬、水沟、店面等结构及相关的协调。

p. All shop drawings shall be submitted in A3 size in addition to full size A0.

所有施工图应提交A0并附加A3尺寸图纸。

q. All revisions will be noted on the drawings. The revised areas shall be bubbled and the revision version indicated. Revise and resubmit only the changed drawings not the full sets of drawings.

所有修改版的图纸均须标示出修改的部份，且须于图纸上以云线标明并标示修改版本和修改日期。图纸重新送审只需针对修改的图纸而不是整套送审图纸。

r. Shop drawings shall be signed dated by the Registered Structural Engineer (RSE) responsible for the calculations and the design/drafting supervisor prior to each first issue submission. Simultaneous submissions are allowed for e.g, if the louvers are submitted, to so with the adjacent conditions, steel, flashing pans, etc. Otherwise the Client Representative reserves the right to reject the submission.

施工图纸第一次送审前，所有图纸需由负责计算书的注册结构工程师(RSE)及设计主管签署。在允许的范围内，可以同时提交一些文件，比如若百叶的相关文件已提交，其相关条件，钢结构、挡水板等也可提交。除此以外业主代表保留拒绝送审件的权利。

G. Calculations
计算

All drawing submissions shall include structural calculations for the work included in the drawing submission.

所有送审的图纸皆应包括所送审图纸对应的结构计算。

The calculations shall be provided as follows:

计算书应包括以下内容：

1. Calculations shall be done in accordance with common, accepted engineering practice and shall conform to appropriate design rules of the reference documents and local codes, standards, and building ordinances. All documents are to bear the signature and seal of a Registered Structural

Engineer (RSE), employed by External Facade Contractor and approved by the Client Representative. The Registered Structural Engineer (RSE, employed by the External Facade Contractor shall provide at the time of submission of the shop drawings to the Client Representative, independent checking engineers certificates.

计算书应依照惯例，且应遵照正确的规范，地方标准及建筑法规。所有结构计算分析皆须由业主代表认可的受雇于外幕墙承包商的注册结构工程师(RSE)签字盖章。受雇于外幕墙承包商的注册结构工程师(RSE)在提交施工图纸时必须提交注册结构工程师的资格证明文件。

2. Calculations shall be provided with design criteria and should match the standards, codes and the requirements stated in this specification. Material specification and mechanical properties shall be included.

   提交的计算书应包括设计标准并且需要符合标准、规范及本技术说明中的要求。并包括材料规格说明及力学性能。

3. Calculation sheets shall be numbered, dated, indexed and referenced. In cases where calculation revisions are required, the revised sheets shall be noted "Revised" and the revision date reflected.

   计算书应有页码、日期、索引和参考文献说明。如有修改，修改的页面上应注明“修改”字样以及相应修改日期。

4. Calculations shall be referenced to drawings details as appropriate. All sketches used shall be referenced to the correct detail/sheet numbers. Dimensions used in the shop drawings shall coincide with the dimensions used in the calculations.

   计算书应与图纸相对应。计算书中所有使用的示意图应注明对应的节点图纸和页码编号。计算书中使用的尺寸必须与图纸中对应尺寸保持一致。

5. Calculations shall be provided with section containing the derivation of member structural/section properties. Full size dimensioned extrusion shape drawings shall be provided and dimensioned in mm.

   提供的计算书中应包括构件的剖面图及其界面特性。并应提供注明尺寸实际大小的模具图(尺寸以mm为单位)

6. Calculations shall be provided with the analyses of stress and deflections for all structural elements, connections, anchorages, and all components subjected to external loads. The typical, special, and worst conditions shall always be analyzed.

   计算书应包括所有受外力荷载的结构构件、连接件、角码转接件等所有构件的应力及挠度分析。标准部位、特殊部位以及最不利工况都必须分析。

7. Calculations shall show free body sketches showing the applied loads, dimensions of eccentricities, and restraining elements.

   计算书应通过受力分析图表明施加的荷载、尺寸大小、偏心率以及制作限制条件等。

8. Calculations shall be provided in readable and easy-to-check format. Given variables shall be defined with brief description for each variable. Formulas and equations shall be presented in a readable format and shall be provided with brief description before any numerical substitution is performed.

   提供的计算书应清楚易懂，易于核对编排格式。对于给出的每个变量应作简单的定义。公式和等式应以易读的形式表示，并应在把数值代入公式前做简单的描述。

9. Calculations shall show ultimate factor of safety.

   计算书应提供极限安全系数。

10. Calculations shall show the ratio of actual stress to allowable stress for all structural non-stone elements (i.e. $f_b/F_b <= 1.0$, $f_a/F_a + f_b/F_b <= 1.0$, etc.). Stress ratio shall be in accordance with the equations given in an applicable codes, specification or standards.

    计算书应显示所有结构性非石材构件的实际应力与允许应力比（比如：$f_b/F_b <= 1.0$, $f_a/F_a + f_b/F_b <= 1.0$, 等)。其应力比值应与实际应用的规范、技术规格说明等相一致。

11. Calculations shall show the ratio of actual deflection to allowable deflection for all relevant structural elements.

    计算书应注明所有相关建筑构件的实际挠度与允许挠度比。

12. Calculations shall show a summary in the computer run that the summation of the loads in the one direction is equal to the summation of reaction loads in the said direction.

    如采用计算机软件计算，应在计算书显示在同一方向上的施加荷载的总量与支座反力的数量和等值。

13. The External Facade Contractor through calculations shall check the following items and include these in the structural calculations which shall be submitted for review. Calculations for each wall types or zones of the External facade Systems shall be submitted separately. The calculations shall have a Table of Contents indicating the sheet numbers pertaining to the following items. Incomplete calculations shall be rejected.

    外幕墙承包商通过结构计算必须验算下列项目，这些项目必须被提交审核。计算书包括目录及页码，不完整的结构计算书将被退件。

    a. Glazing

       玻璃

       1) Each Glass type shall be checked according to ASTM E 1300 (latest edition) specification or JGJ 102-2003 whichever is most stringent governs.

          每一种玻璃都应该符合ASTM E 1300的最新版本或JGJ 102-2003规定，遵守其中最严格的规定。

2) Each Glass type shall be checked for strength and stress, considering the largest lite and worst condition of the wind load specified.

每一种型号的玻璃应考虑最大尺寸及最不利风荷载工况下，对其进行强度及应力复核。

3) Each Glass type shall be checked for deflection, considering the largest lite and worst condition.

每一种型号的玻璃应考虑最大尺寸及最不利风荷载工况下，对其进行挠度复核。

4) Point supported glass units shall be checked using a valid engineering analysis. Stress concentrations at edge of glass hole shall be checked at worst condition.

点式幕墙应采用有效工程分析方法进行核查。应考虑最不利状况下玻璃开孔边缘处的集中应力情况。

5) Structural sealant shall be checked for the largest lite and worst condition.

结构胶验算根据最大尺寸玻璃和最不利受力状况。

b. Aluminum panels

铝板

1) Aluminum panels shall be checked for the worst condition of the wind load specified in this specification.

根据本技术规格说明书中指定的最不利风荷载工况下复核铝板。

2) Panel strength/stress shall be checked.

复核铝板的强度及应力。

3) Panel deflection shall be checked.

复核铝板的挠曲。

4) Panel stiffeners shall be checked for deflection and stresses.

复核铝板加劲肋的挠曲及应力。

5) The connections from the panel to the stiffeners shall be checked.

复核铝板与加劲肋的连接部位。

6) The connections from stiffeners to framing members shall be checked.

复核铝板加劲肋与框料的连接部位。

7) Panel framing members shall be checked for deflection and stress.

复核铝板框料的挠曲及应力。

8) The connections from framing members to mullions or rails shall be checked.

复核铝板框料与竖、横料的连接部位。

c. Stone panels

石材板块

1) Stone panels shall be checked for the worst condition of the wind load specified in this specification.

石材板块须在本施工规范指定的风压最恶劣的环境下进行检查。

2) Stone strength/stress shall be checked.

复核石材的强度/应力

3) Stone deflection shall be checked.

复核石材的挠度

4) Stone panel stiffeners shall be checked for deflection and stress.

对于石材板块加强筋的挠度和应力需复核其强度

5) Stone panel clip anchors or bolt shall be checked

复核石材板块的夹固件或背栓

d. Wall mullions

幕墙竖料

1) Wall mullions shall be checked for wind load specified in this specification.

根据本技术规格说明书中指定的风荷载复核幕墙竖料。

2) The mullion strength at the support shall be checked.

复核支撑处的竖料强度

3) The mullion strength at mid span shall be checked.

复核中跨度处的竖料强度

4) The mullion deflection at mid span shall be checked.

复核中跨度处的竖料挠度

5) The mullion deflection at the splice shall be checked.

复核连接处的竖料挠度

e. Outside corner mullions

外转角竖料

1) Outside corner mullions shall be checked for wind load specified in this specification.

复核外转角竖料的风荷载受力情形。

2) The strength of the corner mullion when subject to both-sides loading shall be checked.

复核外转角竖料双边均受力时的强度。

3) The deflection of the corner mullion parallel to the wall when subject to both-sides loading shall be checked.

复核平行于墙面的外转角竖料双边均受力时的挠曲。

4) The strength of the corner mullion when subject to one-side-only loading shall be checked.

复核外转角竖料单边受力时的强度。

5) The deflection of the corner mullion parallel to the wall when subject to one- side-only loading shall be checked.

复核外转角竖料单边受力时的挠曲。

f. Inside corner mullions

内转角竖料

1) Inside corner mullions shall be checked for wind load as specified.

复核内转角竖料的风荷载受力情形。

g. Horizontal rails

水平栏杆

1) Horizontal rails shall be checked for wind load as specified.

复核水平栏杆的风荷载受力情形。

2) The rail strength subject to wind load shall be checked.

复核栏杆因风荷载产生的强度。

3) The rail strength subject to dead load shall be checked.

复核栏杆因自重产生的强度。

4) The deflection of the rail perpendicular to the wall shall be checked.

复核栏杆产生垂直于墙面的挠曲。

5) The deflection of the rail parallel to the wall shall be checked.

复核水平栏杆平行于墙面产生的挠曲。

h. Connections

接点

1) The connections from horizontal rails to mullions shall be checked.

复核水平栏杆和竖料的连接部位。

2) The connection from the transom to the mullion shall be checked.

复核上横料连接竖料的连接部位。

3) The connection from the unit sill to the mullion shall be checked.

复核单元板块窗台板与连接竖料的连接部位。

4) The connection from the gutter to the mullion shall be checked.

复核集水槽连接竖料的连接部位。

5) The connection of the rails to the corner mullions shall be checked.

复核栏杆连接转角竖料的连接部位。

6) Cast stainless steel spider fittings shall be checked.

复核不锈钢爪件。

i. Operable windows

活动窗

7) Operable windows shall be checked.

复核活动窗。

8) The framing of the operating windows shall be checked for deflection and stress.

复核活动窗框料的挠曲及应力。

9) The components or devices that hold the operating windows structurally against outward wind load shall be checked.

复核活动窗构件或固定活动窗的装置的结构抗风性能。

j. Splices

插芯

10) Splice connections between framing members shall be checked.

复核框架构件的接点。

11) Splices between vertical mullions shall be checked.

复核两竖料间的插芯。

12) Splices at the corner mullions shall be checked.

复核转角竖料料的插芯。

k. Anchors

锚件

13) Wall anchors shall be checked.

复核标准锚件。

14) Corner anchors shall be checked.

复核转角锚件。

l. Seismic load

地震荷载

1) Seismic load and its effect to the curtain wall framings and anchors shall be checked.

复核地震荷载和对幕墙框架、连接件的影响。

m. BMU Track

擦窗机轨道

1) The BMU track shall be checked for pullout, side-to-side loads.

复核擦窗机轨道受向外、左边、右边拉力作用时的受力。

n. Thermal movement

温差位移

1) Thermal movement shall be checked.
复核因温差造成的位移。

H. Samples.
样品

All samples shall be submitted for approval by the Design Architect. Costs related to the submission of samples by courier to Consultants in foreign countries (and retrieval) shall be borne by the External Facade Contractor.
所有送审样品须经建筑师认可。送审样品快递到顾问公司国外（包括收件）的费用应由外幕墙承包商承担。样品应送至业主, 建筑师, 幕墙顾问及总承包商.一份样品须架放于总承包商的工地办公室。

The samples shall include the following:

样品应包括如下：

1. Aluminum color samples - five (5) sets color range samples for each finish. Extrusion samples shall be 300mm in length for all types; sheet samples shall be 300mm × 300mm in size.

   彩色铝材样品——各种类型表面处理皆应提供5组有颜色的样品，铝型材的样品长度应为300mm；铝板样品应为300mm × 300mm。

2. Extrusion samples – Provide one (1) mill finish sample of each extrusion profile that shall be used in the project. The samples shall be selected from actual production and shall be fully representative of the project material including alloy, temper and profile tolerances. Sample shall be 12” (300mm) in length.

   铝型材样品－提供用于该工程的各种类型铝型材毛料各1支。送审样品从实际量产的生产线上取得应该要完全代表本工程所使用的成品，包含合金、硬度及外型误差等。样品长度为300mm。

3. Aluminum perforated panels and solid panels.

穿孔铝板及铝单板

4. Glass - three (3) 300mm × 300mm samples of each vision glass type shall be provided with the tender submission. A further five (5) samples of each type of glass shall be allowed fortechnical submissionsof glass for selection, post contract award, should be allowed for. These samples shall be a minimum of 600mm × 600mm.

   玻璃－在提交投标送审文件时，请同时提供各种可视玻璃300mm × 300mm的样片各五（5）片。另外，在提交技术送审时，在开标前须提供各种可视玻璃样片各5块以供选择。这些样品的尺寸至少应为600mm x 600mm。

5. Stone - five (5) 300mm × 300mm samples of each stone type.

   石材-各种类型的石材各五(5)块 300mm × 300mm 样品

6. Stone anchors - five (5) samples of each type.

   石材锚固-各种类型的石材各五(5)块样品

7. Gaskets, joint fillers, backer rods, sealant, adhesive tapes, sealing tapes, etc. - five (5) 300mm (12") long samples of each type. Include factory-vulcanized corners.

   胶条(Gasket)、接缝填塞材料(Joint Filler)、填充绵(Back rods)、硅胶(Sealant)、胶带(Adhesive Tapes)、密封胶带(Sealing Tapes)等——各种类型应提供长度300mm的5件样品，包含工厂成型转角的止水压条。

8. Weep baffles, setting blocks, spacers, shims, fasteners, hardware, etc. - five (5) samples of each type.

   排水孔泡绵玻璃垫块、间隔片、垫片、紧固件、五金等——各种类型应提供 5 件样品。

9. Flashings and waterproofing - five (5) 100mm × 100mm samples of each type including metal and flexible membrane types.

   防水板(Flashing)及防水材料——各类型皆应提供 5 件 100 × 300mm 的样品，包含金属及柔性防水卷材类型。

10. Insulation - five (5) 300mm × 300mmsamples of each type with technical data.

    保温棉——各种类型皆应提供5件300mm × 300mm的样品。

11. 300mm length of fire safing & fire stopping with technical data.

    300mm长防火棉及防火材料并附上其技术数据。

12. Fire Barriers

    防火间隔(Fire Barrier)。

13. Bird screen material.

    防鸟网材料

14. Anti-drumming materials.

防震动材料。

15. All Stainless steel cladding materials

所有不锈钢覆面板材料

16. Painted Built Up steel mullions and Transoms

喷涂钢龙骨及横梁

17. All extrusion die drawings and 300mm long samples of the production run on all extrusion shapes involving a snap fit. Snap fits are to be designed using 1/2 standard tolerances.

所有型材模图和 300mm)长所有类型截面型材样品，包括压条等。压条设计为规范允许误差的 1/2。

18. Glass setting blocks, side spacers, gaskets and shims.

玻璃垫块，侧边垫片，胶条和垫片

19. Samples of gaskets, rods, tapes, glazing accessories. Gasket test reports, sealant test reports, and technical data on all glazing accessories.

胶条、泡沫棒、粘结胶条和其他玻璃安装配件的样品。胶条测试报告，硅胶测试报告，和其他玻璃安装配件的技术参数应有实验室的章盖。

20. Samples of operable window sash and frame, door construction, door frame and thresholds.

开启窗窗扇、窗框，门结构，门框和限位器样品

21. Architect reserves right to require submittal of fabrication samples, showing prime members, joinery, anchorage, expansion provisions, glazing, sealant details and similar details, profiles and intersections.

建筑师有权要求提供加工样板，以便展示主要构件、接缝、角码、膨胀预留缝、胶条和密封胶和相似细部、外形和连接部位。

22. The Client Representative reserve the right to require additional samples, which show the fabrication techniques and workmanship of component parts, and the design of accessories and other exposed auxiliary items, before fabrication of this work proceeds.

于所有材料加工前，业主代表、顾问及业主代表有权要求额外的表现加工技术及工艺的样品及其附件，或依设计要求的其它附属材料

23. All the samples shall be accompanied by additional descriptive information or technical data which shall include as a minimum - country of origin, country of fabrication, finishing, brand, manufacturer’s data sheet, application/use instructions, MSDS where applicable for hazardous materials.

所有样品于送审时至少需包描述信息包括原产地、加工国家、表面处理、品牌、制造商技术资料、使用说明/指导。具有危险性的材料必须详加说明使用方法及注意事项。

I. Proposal Material Substitutions

替换材料

1. Unless the client request or approved to substitute the material, Where permitted in material specifications, alternative materials to those specified may be considered for substitution. Any alternative material shall be equal or better than specified material. This shall be demonstrated by the External Facade Contractor who shall provide the following documentation when submitting a proposed alternative material:
除非业主主动提出或同意更换的情况下，在材料规范容许范围内，替换材料是可以被考虑的。任何替换材料的规格及等级必须比指定的材料的规格及等级相同或更高，外幕墙承包商提出替换材料时，亦需一并提供下列文件：

   a. Summary sheet with a one-on-one comparison of all key technical properties of the specified and proposed alternative material.

      依提供规定材料与替换材料主要特性汇总比较表。

   b. Material sample where required in Article 1.08 – Paragraph H of this specification.

      依1.08.H规定提供样品。

   c. Additional descriptive information which shall include as a minimum -country of origin, country of fabrication, finishing, brand, manufacturer's data sheet, application/use instructions, MSDS where applicable for hazardous materials.

      所有样品于送审时至少需包描述信息包括原产地、加工国家、表面处理、品牌、制造商技术资料、使用说明/指导。具有危险性的材料必须详加说明使用方法及注意事项。

   d. Statement that specified warranty requirements shall be met for the proposed alternative material and that the specified warranty shall not be compromised in any way by the material substitution.

      替换材料的质保声明必须符合原规范保证规定的要求，不得有任何降低。

2. Any proposed alternative material submittal not in compliance with reference standards and this specification shall be rejected as incomplete and shall not be reviewed/ approved by both the Design Architect and Client Representative.

   任何替换材料如不符合的相关规范或本技术规格说明书，将被视为不完整予与退件，设计建筑师及业主代表将不对其进行审核。

1.09 QUALIFICATIONS 资格

1) The work of this Section shall be performed by one subcontractor, who is regularly engaged in the engineering, manufacture, fabrication, finishing, installation, glazing and sealing of glass, sealing, stone material and similar work. Subcontractor shall demonstrate to the satisfaction of the Client Representative that they have successfully performed comparable projects over the previous ten years.

本节中的工作应有由单独的外墙承包商进行，该承包商在幕墙的设计、制造、加工、表面处理、安装、镶嵌玻璃、填缝、石材及相关工程方面具有经验。承包商应向业主证明其在过去 10 年间，成功地完成类似本工程规模的幕墙工程。

2) All fabricating and finishing shall be done in the subcontractor's own plant or approved suppliers, except as provided for hereinafter. The subcontracting of any work included here under is specifically prohibited, except that which may be accepted by the Client Representative in writing prior to award of this contract

除规范特别指定，所有加工及表面处理需于外墙承包商的工厂，或被核准供货商的厂房内完成。除非业主代表书面授权，否则本工程所有工作不得分包。

1.10 QUALITY ASSURANCE 质量保证

A. The Client Representative reserves the right to visit the fabricating facilities of the External Facade Contractor, any approved sub-contractor, and accepted test laboratories, at any time while work is in progress. All shop and field materials and workmanship shall be subject to observation by the Client Representative, or his representatives at all times. Such observations shall not relieve the External Facade Contractor from his obligation to provide materials and construction conforming to all requirements of the contract documents. The External Facade Contractor shall promptly correct any deficiencies reported and shall carry out his own control measures for all materials, whether inspected or not.

业主代表、顾问拥有视察外幕墙承包商制造设施的权利；包括核准的分包商及测试实验室，且可于工程进行中的任意时间进行视察。业主、业主代表、顾问及其代表人可随时视察厂房、现场材料及施工，这种视察不可以降低或减免外幕墙承包商的根据合约要求提供材料及施工的责任。外幕墙承包商应尽快整改报告指出缺陷，无论是否有检查，外幕墙承包商应自行根据其质量控制检查其材料。

B. All testing shall be performed by accredited laboratory personnel and witnessed and certified by a qualified Professional Engineer.

所有测试皆应由认可的实验室人员进行并由专业工程师见证。

C. Method of fabrication and assembly (except as specified herein, or as recommended by the Client Representative as a consequence or result of testing) shall be at the discretion of the External Facade Contractor. The exterior and interior visible architectural effect shall not be changed, the quality of work of the External Facade Contractor as demonstrated by engineering calculations and measured by the results of the test performance requirements, shall not be reduced.

除非技术规格说明书特别说明，或业主代表及顾问建议，或测试结果，外幕墙承包商需特别注意加工及组装的方式。所有室内及室外的可见建筑造型效果不可变更，外幕墙承包商的工作质量要通过结构计算及测试效能的规定质量要求证明，不可有任何折减。

D. Remedial measures, which may be necessary on the mockups or the building, shall maintain specified standards of quality and durability and are subject to acceptance by the Client Representative.

性能试验及安装过程中的补救方法，必须符合质量和耐久性的规定，并且获得业主代表及顾问同意。

E. The Client Representative shall have the final authority to accept or reject any or all materials not meeting the finishing standards or other requirements of the drawings and specifications.

业主代表有权接受或拒绝任何或所有不符合最终规范或其它图纸、规范要求的材料。

F. Complete certified inspection records for quality of finish and complete finishes process records shall be maintained. Such records shall be made available to the Client Representative upon request.

所有已完成的完工程序质量视察或完工工序视察认证记录都应存档。这些记录应能随时应要求提交业主代表。

G. Certifications.证书

1. Glass
玻璃

Provide the following items as per Article 2.04 Paragraph I of this specification, where necessary certification of glass performance shall be carried out by an independent accredited laboratory. Letters shall be on glass manufacturer's letterhead and signed by qualified technical representative:

请提供根据本技术说明 2.04 章 I 节要求提供下列几项，在需要的时候应由独立有资质的测试实验室提供玻璃性能的证明。所有信件必须以公函形式出具，并且由合格技术人员签署。

a. Shop drawing review and acceptance certificate.

施工图审核及认可证明。

b. ASTM E 1300 - 2007e1 glass load resistance analysis.

ASTM E-1300 风压分析

c. Thermal stress analysis and statement.

温差应力分析报告。

2. Sealants
密封胶

Provide the following items from the sealant manufacturer as per Article 2.05 Paragraph Eof this specification. Letters shall be on sealant manufacturer's letterhead and signed by qualified technical representative:

填缝剂制造商需依据本规范 2.05.E 出具下列信函，所有信件必须以公函形式出具，并且由合格技术人员签署。

a. Compatibility and adhesion test reports.

兼容性及黏着性测试报告。

b. Non-staining test reports.

非污染性测试报告。

c. Water immersion test reports.

浸透测试报告。

d. Shop drawing review and acceptance certificate.

施工图审核及认可证明。

e. Stress statement for structural silicones.

结构硅胶的结构计算。

f. Independent laboratory testing of structural sealants

结构硅胶的实验室独立测试。

1.11 REGULATORY REQUIREMENTS 管制规定

A. All work shall be performed in accordance with the applicable building code, and the requirements of this specification whichever is more stringent. The External Facade Contractor shall obtain all necessary permits and approvals as may be required by regulatory authorities in conjunction with the work performed by the External Facade Contractor and shall perform all tests, submit all required documents, make all modifications, etc., as required to obtain such approvals.

所有工作应依照适用的建筑法规，或依本技术规格说明书的要求进行，以二者中较严格者为准。分包商应依政府建筑部门的要求，取得所有必需的许可证，并应进行由此带来的所有必需的测试，呈交所有必需的文件，及所有必需的修改。

B. The External Facade Contractor shall submit to the Suzhou BuildingsDepartment all necessary documents to obtain the required approvals and consents.

外幕墙承包商需送审所有相关文件至苏州政府建筑部门，取得所有必需的核准及许可证。

C. The External Facade Contractor shall allow for review and approval from the Suzhou Buildings Department without delay to the overall schedule.

外幕墙承包商送审所有相关文件时，必须让中国苏州建筑部门有足够时间审核，不可影响总进度。

1.12 PROTOTYPES AND MOCK-UPS 视觉样板及性能测试

A. The curtain wall shall be tested as shown in Architectural drawing. There are a total of [4] proposed specimen performance mock up tests.

外幕墙承包商应该提供[4]个性能试验模型并测试，测试部位及大小参考建筑图。

B. The laboratory for the mock-up shall be determined by the External Facade Contractor and approved by the Client Representative.National building material Test center in Beijing; Shanghai Research Institute Building Science, Shanghai, China; Research Engineering Development, Guangzhou, China are approved for mock-up testing. Other laboratories may be acceptable and are subject to approval

if requested in writing prior External Facade Contractor's bid proposal. Erection of mock-up shall not commence prior to laboratory approval. In any case, the test shall be carried out under the direction of a testing authority independent of the manufacturer of the External Facade Systems and acceptable to the facade consultant

风雨试验实验室由外幕墙承包商和业主代表及顾问方共同决定。核准风雨试验实验室为：位于北京的国家建筑材料测试中心；位于上海的上海建筑幕墙检测中心;位于广州的广东省建研院幕墙检测中心。其它实验室及制造商的设施亦可能被接受，外幕墙承包商在投标之前书面提出供业主和顾问核准。模型的安装不可以在审核通过之前进行。无论如何，测试应该在独立于外幕墙系统制造商的权威检测机构的指导下完成，并且需由幕墙顾问认可。

C. The base fee for the testing laboratory for mock-up shall be the responsibility of External Facade Contractor. Any additional fees, penalties, retest costs, etc., for mock-ups shall be the sole responsibility of the External Facade Contractor. In addition, the External Facade Contractor shall include a provision in their bid for all travel, accommodation and related expenses for Owner's, Architect Representative's, and Consultant's attendance at mock-up erection and testing. The provision shall include Three (3) Owner's representatives, five (5) Architect Representative's and two (2) Consultant's representatives.

风雨试验的所有费用应由外幕墙承包商负担，其它额外的费用、罚款及重新测试的费用亦应由外幕墙承包商负担。除此的外，外幕墙承包商应在标书中说明将负担业主、建筑师及顾问参加风雨试验的差旅及膳食费用。在进度审查阶段参加人员为，业主代表 3 人，建筑师代表 2 人，顾问代表 2 人。在最终审查/批核会议参加人员为，业主代表 3)人，建筑师代表(2)人，顾问代表(2)人。

D. In the event that mock-up failures necessitate retests, the External Facade Contractor shall pay the additional laboratory fees and any other fees and expenses, including the cost of witnessing by the Owner, Architect, and Consultants and all other fees and expenses incurred by the Owner as a result of retesting. All necessary corrections shall take place in the presence of the Client Representative.

如因失败需再行测试，外幕墙承包商除应负责实验室额外的费用外，亦应负责业主、建筑师及顾问因再测试所产生的一切费用及开支。所有试体的修改必须有业主、建筑师及顾问代表在场。

E. The External Facade Contractor shall furnish all labor and materials to build and test mock-up, as shown on drawings. Mock-ups shall accurately represent job conditions, including glass, glazing, joints, sealants, anchors, and finishes. Provide at least one light of extra glass for each type and size on mock-up. Glass which breaks during testing shall be replaced with new glass. Repeated glass breakage of mock-up glass constitutes failure.

外幕墙承包商应提供所有人工及材料，并依图纸的指示制造模型进行测试。模型应精确模拟实际工作现场的状况，包括玻璃、镶工、隔热、连接点、密封胶、铁件及表面材料。每一种尺寸及形式的玻璃必须至少额外准备 1 片，以更换于测试中破裂的玻璃，玻璃如再破裂，则视为失败。

F. Mock-ups shall be fabricated at the same locations and by the same personnel who

will execute this work for the project. Mock-up installation shall be performed by the same personnel who will execute this work on site. A list of both fabrication and installation personnel, their titles, work experience, and duties for this project (beyond the mockup) shall be submitted for review prior to mockup fabrication.

模型应由实际负责本工程的相关人员进行加工、组装及镶嵌，并应于同一地点进行，模型亦需由将在工地上施工的人员进行安装。于性能试验前，外幕墙承包商必须送审本工程（不仅限于模型测试）的加工及组装人员名单、职位、经历及职责等清单。

G. All simulated structural supports for mock-up shall be designed, drawn, and furnished by the External Facade Contractor and coordinated with the Testing Laboratory.

外幕墙承包商应与实验室协调，设计并绘制支撑试件模型的模拟主体支撑结构。

H. Mock-ups shall be constructed in strict accordance with approved shop drawings and all methods of mock-up joint assembly shall faithfully represent actual job conditions. No special measures or techniques may be used that are not representative of those to be used on the building. Any changes or deviations from the drawings shall be subject to approval and, if approved, incorporated into 'as-built' drawings. Necessary remedial work shall be performed in the presence of the Consultant and/or other authorized representative. The as-built drawings shall be provided to the Client Representative and Owner immediately upon completion of the testing.

模型的建造应严格遵循核准的细部图纸，性能试验组装需与实际工程相同，不使用于本工程中的特别技巧，不可使用于性能试验中。任何不同于施工图纸的改变或偏差皆应取得核准，如经核准，仍需要将修正部分列入竣工图纸，必须的整改工作需要在顾问方或授权代表在场下进行。试验完毕后，立即将竣工图交于业主代表及业主。

I. All remedial sealants applied to the specimen after testing has begun shall be of significantly different color than any sealant used in the assembly or erection of the specimen.

所有测试后修正时施打的密封胶，其颜色不可与组装及安装时使用的密封胶相同。

J. Prior to the beginning of mockup testing, all sealant cartridges (full and used) in the chamber shall be of a different color than that of any sealant which has been used in the assembly or erection of the mockup specimen.

于性能试验前，所有于试体腔体内尚未使用的密封胶，其颜色不可与组装及安装时使用的密封胶相同。

K. If any sealant of the same color as the one used in assembly or erection of mockup is found in the chamber or applied to the exterior, the mockup shall be considered a failure and testing is stopped.

测试开始后，试体腔体内尚未施打的密封胶及试体上施打的密封胶，若发现其颜色与组装及安装时所用的密封胶相同，则性能试验视为失败。

L. Preliminary and unofficial tests shall not be permitted. All test results and

remedial work shall be documented in the laboratory report, and submitted to Main Contractor and Client Representative.

不可做预先、非正式的测试，所有测试结果及修正工作皆应在实验室的测试报告内记载说明，并送审于总包方、业主代表及顾问。

M. Upon completion of the mock-up, the External Facade Contractor shall keep the dismantled mock-up specimen in a designated and protected location by the Owner, Architect and Client Representative, until the project is completed. The mock-up specimen will serve as reference to any problem encountered during the execution of the project.

在实验完成之前，外幕墙承包商应根据业主、建筑师、甲方代表的指令，在制定区域保留拆除下来的试验模型直到项目结束为止。试验模型将在项目进行过程中出现任何问题时作为参考进行分析。

N. Mock-up configurations are shown on attached drawings. Mock-ups design pressures shall be following:

性能试验范围如附上的图纸，性能测试的测试风压值应遵从下列要求：

1) for tower facade: -3kpa, +2.5kpa

   塔楼大面：-3kpa, +2.5kpa

2) for Podium: -2.5kpa, +2Kpa

   裙楼：-2.5kpa, +2Kpa

O. External Facade Contractor shall coordinate chamber availability, shipping schedules, and mock-up construction schedules directly with the approved testing laboratory.

外幕墙承包商负责与实验室所有沟通及协调事项，如：实验室的档期、运输、测试时间的安排。

P. External Facade Contractor shall provide an allowance for seven (7) representatives from Owner, Main Contractor, Architect Representative and Consultants and Architects to observe erection and testing.

外幕墙承包商要提供业主、总包方、业主代表、建筑师和顾问方至少 7 名成员用于观察安装和测试的费用。

Q. Provide extra materials for mock-up construction.

外幕墙承包商须准备风雨试验所需的额外材料，以备测试破损时的更换。

1. Provide 1.5 times the required aluminum and stainless steel materials.

   所有铝料的一点五倍量。

2. Provide one (1) extra glass lite for each special size.

   每种特殊尺寸的玻璃各多一片。

3. Provide three (3) extra glass lites for typical size.

   标准尺寸的玻璃各多三片

4. Provide two (2) times the required linear footage for all gaskets, sealants and like materials.

   所有胶条、密封胶及类似材料准备两倍量。

R. Laboratory tests on full-scale mockups.

实际尺寸模型的实验室测试

Set up and make complete installation of mock-up at testing laboratory. Mock-up shall be used to demonstrate quality of materials, finish and workmanship as well as to show compliance with performance criteria and shall be subject to approval for these criteria by the Client Representative. Upon completion of satisfactory tests, dismantle mock-up and as directed by the Client Representative, deliver mock-up or portions thereof boxed to job site, External Facade Contractor's plant or turnover property to testing laboratory.

于实验室设置并完成试体的装设。试体需能展示符合规范效能规定的材料品质、表面处理及手工，并为业主代表所接受。测试完成后，外幕墙承包商需依业主代表指示分解试体；将试体或部分试体装箱运送至工地或外幕墙承包商工厂；或交由实验室处理。

1. Mock-up test will be halted after failure of any item with the exception of window washer tie back. Testing will re-start from the beginning of sequence upon its resumption.

   除擦窗机牵制扣测试项目，任何项目若试验失败时，试验将停止。于修正后重新开始测试此项目。

2. Testing sequence shall be: 测试程序为

   1) Open and close all vents 25 times. *(Shall be performed only if there is an operable window)*

      打开和关闭所有通风孔 25 次。（仅在有开启窗时进行）

   2) Preload at 50 percent of inward design pressure.

      先将模型进行初压，其压力为测试正风压力的 50％。

   3) Concentrated working load test (670N) of window washer tie-back.

      擦窗机拉杆的集中工作应力试验(670N)。

   4) Air infiltration by static method（GB and ASTM）, including chamber calibration.

      静态气密性试验（国标及美标），包括箱体校正。

   5) Water infiltration under uniform static pressure.

      均等静态漏水试验（美标）。

   6) Water infiltration under according to GB

      国标水密性测试

   7) Water infiltration under dynamic pressure, including engine calibration.

动态漏水试验，包含引擎校准。

8) Structural test at 50 percent and 100 percent of inward design pressure.

以 50％及 100％的正风压(测试压力)进行结构测试

9) Structural test at 50 percent and 100 percent of outward design pressure.

以 50％及 100％的负风压(测试压力)进行结构测试。

10) Structural test according to GB code

国标抗风压检测

11) Repeat open and close vents 5 times. *(Shall be performed only if* there *is an operable window)*

重复开关通风口 5 次。（仅在有开启窗时进行）

12) Repeat static air infiltration test according to ASTM

重复静态空气渗透试验（美标）

13) Repeat static water infiltration test according to ASTM

重复静态漏水试验（美标）

14) Repeat dynamic water test according to AAMA.

重复动态漏水试验（美标）

15) Interstory differential vertical movement phase I (up and down，left and right, in and out), in accordance with the value in Article 1.07 – Paragraph B.6.a.

根据第 B.6.a 段第 1.07 条数值进行第一阶段层间位移（上、下、左、右、内、外）

16) Intermediate floor shall be jacked to simulate maximum open position of the stack joint, in accordance with the value in Article 1.07 – Paragraph B.6.a.

根据第 B.6.a 段第 1.07 条数值抬高中间楼板模拟接口开口最大状态。

17) Repeat open and close vents 5 times. *(Shall be performed only if there is an operable window)*

重复开启、闭合通风口 5 次（仅在有开启窗时进行）

18) Repeat static air infiltration test according to ASTM

重复静态空气渗透试验（美标）

19) Repeat static water infiltration test according to ASTM

重复静态漏水试验（美标）

20) Repeat dynamic water test according to AAMA.

重复动态漏水试验（美标）

21) Thermal Cycling Test and Condensation Test. *(The External Façade Contractor has the option of performing this test separately or perform calculation using a computer simulation of the curtain wall system)*

热循环试验和结露试验。（外幕墙承包商可以选择单独做此试验）

22) Repeat open and close vents 5 times. *(Shall be performed only if there is an operable window. Shall be performed only if Thermal Cycling Test and Condensation Test is performed on the actual specimen)*

重复开启、闭合通风口 5 次（仅在有开启窗时进行，仅在实际模型上进行热循环和结露试验中进行）

23) Repeat static air infiltration test. *(Shall be performed only if Thermal Cycling Test and Condensation Test is performed on the actual specimen)*

重复静态空气渗漏试验（仅在实际模型上进行热循环和结露试验中进行）

24) Repeat static water infiltration test. *(Shall be performed only if Thermal Cycling Test and Condensation Test is performed on the actual specimen)*

重复静态漏水试验（仅在实际模型上进行热循环和结露试验中进行）

25) Repeat dynamic water test. *(Shall be performed only if Thermal Cycling Test and Condensation Test is performed on the actual specimen)*

重复动态漏水试验（仅在实际模型上进行热循环和结露试验中进行）

26) 150% Interstory differential lateral movement phase II (left & right，in and out).

第二阶段 150%层间位移试验（左、右、内、外）

27) Structural Safety test at 75 percent and 150 percent of inward design pressure.

以 75％及 150%的正风压(测试压力)进行结构测试。

28) Structural Safety test at 75 percent and 150 percent of outward design pressure.

以 75％及 150%负风压(测试压力)进行结构测试。

29) Repeat open and close vents 5 times. *(Shall be performed only if there is an operable window)*

重复开启闭合通风口 5 次（仅在有开启窗时进行）

30) Concentrated ultimate load test (2700N) of window washer tie back to failure.

擦窗机极限集中荷载试验（2700N）

3. Air infiltration test shall conform to ASTM E 283. Differential static test pressure shall be 300Pa for ASTM and Pressure required by GB code. Chamber leakage shall be accurately determined, not estimated. Fixed panels are included in fixed wall area, and shall not be included in operator crack perimeter. For dual windows, only the primary window is considered for determination of fixed area or operator crack perimeter. Air leakage criteria shall be as specified in *Article 1.07 Paragraph C*.

   气密性测试需符合ASTM E 283及国标GB21086，测试时所用的气压差为 美标300Pa及国标要求压力差。试验房的漏气量应精确算出，而非估计。固定面板系包括在固定墙区，而非属于在活动窗四周有缝区域。如为双窗(dual window) 时，仅可以主窗为固定墙区域或活动门窗区域。空气泄漏率请见技术规范1.07.C内容。

4. Perform concentrated load test on window washer tie back as follows:
   擦窗机拉杆的试验如下

   a. Apply 150lbs (670N) working load and 600lbs (2700N) ultimate outward for at least 10 seconds each.

      670N (150 lbs) 工作荷载及2700N (600 lbs) 极限极限于轴向（外拉），每次10秒。

   b. Apply 150lbs (670N) working load and 600lbs (2700N) ultimate side load in either direction for at least 10 seconds each.

      670N (150 lbs) 工作荷载及2700N (600 lbs) 极限荷载于侧向（左、右），每次10秒。

   c. There shall be no failure or permanent distortion of the track or any part of the exterior wall.

      擦窗机拉杆及幕墙组件不得有任何失效或永久变形。

5. The definition of water leakage shall be based on Article 1.07- Paragraph D of this specification. Where the test sequence or test failure requires successive water infiltration tests, the only means used to drain water from internal cavities shall be gravity drainage through the weep system for a minimum of 15 minutes. Air pressure, removal of parts or other means of draining water shall not be used. All weep tubes shall be clear plastic.

   漏水的定义详见1.07.D。当测试程序本身要求，或因测试失败而需再进行水渗透测试时，唯一可以将水由系统内部排出的方式，为经由排水系统自然排出，至少 15分钟，不可使用气压，拆下零件，或其它方式排水。所用的排水管必须为透明塑料管。

6. Static water infiltration test shall conform to ASTM E 331. Differential test pressure shall be 15psf (720Pa). There shall be no unacceptable water leakage as defined herein.

   静态漏水测试需符合ASTM E 331，静压力差应为720 Pa，不得发生本规范所定义的不容许漏水。

7. Dynamic water infiltration test shall conform to AAMA 501.1 except as otherwise specified herein. Differential test pressure shall be 15psf (720Pa). There shall be no unacceptable water leakage as defined herein.

   动态漏水测试应依据AAMA E 501.1，或依本文中的其它规定。测试压差应为720 Pa，且不得发生本规范所定义的不容许漏水。

8. Structural tests shall conform to ASTM E 330. Deflection gauges shall be set to zero prior to each application of pressure at 50, 75, 100, and 150 percent of design pressures. Deflection gauge readings shall be recorded after each application of pressure. Deflection measurements are not required for the initial preload. Deflection criteria shall be as specified in Article 1.07-Paragraph A.4.

   结构测试需符合ASTM E 330，在每次施加设计压力的50、75、100及150%压力的前，应先将测位器归零，每次施加压力之后，应记录测位器读数，初预压时无需测量其变形。挠度变形标准的要求详见1.07.A.4。

9. Interstory differential displacement (up and down) for the mockup test shall be± (____mm) based on Article*1.07- Paragraph B.6.a.*

   根据第1.07条第B.6.a段进行第一阶段层间位移（上、下）量应为± (____mm)

   a. The mock-up test chamber shall be constructed so that the simulated floor structure at approximate mid-height of the mock-up is moveable in a vertical sense parallel to the glass plane (s).

      模型测试室的建造应使位于模型一半高度处的仿真地板，可在与玻璃面平行的状况下，作水平与垂直移动。

   b. Displace moveable structure first in one direction, then in the other direction. Repeat for a total of at least five (5) two-stroke cycles.

      结构位移先向一个方向，然后向另一个方向，重复此过程至少5次

10. Interstory differential lateral displacement (left and right sideways) for the mockup test is ± (____mm) based on *Article 1.07- Paragraph B.6.b.*

    根据第1.07条第B.6.b段进行第一阶段层间位移（左、右）量应为± (____mm)

    a. The mock-up test chamber shall be constructed so that the simulated floor structure at approximate mid-height of the mock-up is moveable in a horizontal sense parallel to the glass plane(s). The repeat static water and air infiltration test shall be tested when inter-storey differential movements (lateral) occur.

       试验箱体应该做到可以使水平传感器位移量达到玻璃板块距离层板间距的一半。层间水平位移开始时重复进行静态漏水和空气渗漏试验。

    b. Movable structure shall be displaced first in one direction (laterally), then in the other direction (laterally). Repeat for a total of at least 3 two-stroke cycles.

结构位移先向一个方向（横向），然后向另一个方向（横向），重复此过程至少3次

c. There shall be no failure or gross permanent distortion of anchors, frames, glass or panels, no gasket disengagement and no weather or structural sealant failures.

构件、骨架构件、玻璃、板片不得失效或过度变形，胶条不得脱落，防水及结构密封胶不得失效

11. Condensation and Thermal Cycling Test shall either be performed on original mockup sample as shown in Attachment [A] or, at the External Facade Contractor's Option 2, smaller sample (one each for wall types 1 and 2).

结露及热循环的试体可附加在原风雨试验试体进行,详见附件[A]，或提供二个较小型的试体。

a. If the first option is selected, thermal insulation shall be installed on the test specimen prior to performing condensation and thermal cycling tests.

如果选择方案一，于结露及热循环测试的前，必须安装隔热材于试体上。

b. If the second option is selected, each sample shall be composed of a minimum of one typical vision module, one typical spandrel module, one complete intermediate transom, one complete stack joint transom, and one complete vertical mullion. Samples shall be provided with thermal insulation installed.

如果选择方案二，每一试体最少需包含一个标准可视单元、窗间墙单元、室外翼板（如果有）、一完整的中横料、完整的垂直伸缩缝（Stack Joint），及一完整的竖料料。试体必须安装隔热材。

12. Thermal Cycle Test 热循环测试

The wall shall be subjected to six thermal cycles with each cycle consisting of:

幕墙需要经过 6 个热循环，如下：

a. Lower the outdoor air temperature to minimum Outdoor Design Condition over a period of one (1) hour.

于1小时内，将室外温度调至最低室外设计温度

b. Maintain temperature at minimum Outdoor Design Condition for period of two (2) hours after equilibrium has been attained.

当温度不再浮动时，维持最低室外设计温度2小时

c. Return outdoor temperature to ambient outdoor temperature over a period of 1hour. Maintain at this temperature for a period of 1 hour.

于1小时内，将室外温度调至正常室外温度，维持此温度1小时。

d. Increase the outdoor temperature to achieve maximum Outdoor Design Condition over the period of one (1) hour.

于1小时内，将室外温度调至最高室外设计温度。

e. Maintain nominal outdoor air temperature at maximum Outdoor Design Condition for period of two (2) hours after equilibrium has been attained.

当温度不再浮动时，维持最高室外设计温度2小时。

f. Return outdoor temperature to ambient outdoor temperature over a period of one (1) hour. Maintain this temperature for a period of one (1) hour.

于1小时内，将室外温度调至正常室外温度，维持此温度1小时。

g. Repeat this cycle six (6) times.

重复此步骤六个循环。

13. Condensation Test 结露测试

Following thermal cycling tests, the wall shall be subjected to a modified 7^{th} cycle of cooling as follows:

于热循环测试后，试体第 7 次冷却循环需修改如下：

a. Lower outdoor air temperature to minimum outdoor design condition for a period of one (1) hour.

于1小时内，将室外温度调至最低设计温度

b. Maintain temperature at minimum outdoor design condition for a period of twelve (12) hours after equilibrium has been attained.

当温度不再浮动时，维持最低设计温度12小时

c. Allow outdoor air temperature to return to ambient air temperature.

让室外温度回复至平正常温度。

14. Spandrel Shadow Box Test (Shadow Box) 楼板背衬板测试（背衬箱）

a. Spandrel shadow box assembly shall demonstrate by test that appearance is not affected by formation of residue on indoor glass surface.

楼板背衬板须以测试确认玻璃表面外观不因内部生成物改变

b. Construct two identical test specimens, each consisting of a full size spandrel glass unit in its aluminum frame, mounted in a test chamber with the same back-up materials intended for the building. Glass, glazing materials, aluminum finish, insulation, backup material, and backup finish shall be identical to production material. Store one specimen indoors; this is the control. Subject the second specimen to a cycled test.

建造二个相同材料的试体，每一个包含实际窗间墙玻璃尺寸、铝框及背衬材料，固定于测试封舱上。玻璃、镶嵌材料、铝表面处

理、隔热材、背衬材料及其表面处理，需与本工程实际使用相同。一个试体放在室内；这是控制样件。把另外一个试体用于循环测试

c. Test shall consist of alternate heating and cooling. Mount thermocouples on center of outdoor glass surface, at center of air space midway between glass and backup, and on center of back-up surface. Heat source shall be sun lamps spaced at 30cm horizontally and vertically. With specimen and light rack standing vertically and parallel to each other, turn on lamps and adjust distance to specimen so that air space temperature stabilizes at 200°F plus or minus 10°F (93°C plus or minus 6°C). Maintain stabilized temperature for one hour minimum. Record thermocouple readings. Turn lamps off and allow specimen to cool until glass temperature is 80 degrees F (27°C) or cooler. Record thermocouple readings. Turn lamps on and repeat for 10 cycles. Examine specimen at 50 cycle intervals and record any residue on indoor glass surface or change in outdoor appearance. At 2cycle intervals, photograph specimen and control side by side, indoors with artificial light and outdoors with sunlight. After 10 cycles, remove specimens from chamber; record and photograph any residue on indoor glass surface or on aluminum frame.

测试为加热及冷却循环，将温度计固定于玻璃室外中央、玻璃与背衬板之间中央处，及背衬板中央，热源需为太阳灯泡，垂直及水平相距 30cm，试体及灯架须垂直放置并互相平行，将灯打开并调整距离，让温度保持在 200ºF 或负 10ºF（93ºC 或负 6ºC）。维持稳定温度至少 1 小时，纪录温度计读数，将灯开、关 10 次并让试体玻璃温度降至 80ºF（27ºC）或更低温度，纪录温度计读数，执行此循环 50 次后，检视玻璃室内测试否有生成物，或室外外观有所改变。在间隔 2 个循环后，室内侧以人工灯照相，室外侧以自然光照相。10 次循环后，将试体从封舱拆下，纪录并照相，玻璃内侧及铝料上的生成物

d. The specimen passes only if there is no visible change in outdoor appearance and no residue forms on the indoor glass surface. If specimen fails, provide specified opacified spandrel glass.

室外外观无变更且玻璃表面无残留物时，则测试视为通过。如果测试失败时，须于玻璃表面提供注明的彩釉。

S. Visual Mockup: There are 4 proposed visual mock ups that shall be provided by the External Facade Contractor as shown in Architectural drawing.
视觉模型：外幕墙承包商应该提供 4 个视觉模型.视觉模型的范围及大小参考建筑图

1. The location of the visual mock ups shall be at the Owner’s discretion, but is likely to be within the location of the Project or contactor’s factory.

视觉模型应该建立在业主指定区域，比如项目现场或承包单位的工厂内。

2. The External Facade Contractor shall submit visual mock up shop drawings to the Client Representative for approval prior to proceeding with procurement of materials. Material samples should be submitted for review and approval.

   在采购材料前，外幕墙承包商应提交视觉模型的图纸给业主代表及建筑师以便审核通过。同时应送审材料样板以便审核。

3. The External Facade Contractor shall allow for providing all necessary foundations, groundwork, and supporting structure for the installation.

   外幕墙承包商应提供所有需要的基础，地面工作和支撑结构以便安装以至用於视察模型时使用的平台及楼梯

4. The External Facade Contractor shall allow for a back up wall for the visual mock ups.

   外幕墙承包商应提供视觉模型的背墙。

5. Include proposed project glass of same heat treatment manufactured by the proposed manufacturer.

   应要求拟用玻璃厂提供项目使用玻璃相同热处理的玻璃。

6. As a part of the typical unit include proposed shadow box system, using proposed project glass of same heat treatment manufactured by the proposed manufacturer and internal and external alum. closure panels with proposed paint finishes provided.

   作为标准单元的一部分，应包括窗间墙系统，要求拟用玻璃厂提供项目使用玻璃相同热处理的玻璃和室内及室外铝包板及项目拟用的喷涂。

7. Include correct gaskets and seals.

   包括正确的胶条及密封胶。

8. Aluminium framing may be simulated such that all exposed visible components are representative with proposed paint finishes provided.

   铝型材应能模拟所有可视的构件及项目拟用的喷涂。

9. Provide internal blinds where required The External Facade Contractor shall allow for any statutory requirement of the buildings Department prior to erection of visual mock up.

   外幕墙承包商应在安装视觉模型前获得建委的许可证。

10. The External Facade Contractor shall furnish all labor and materials to build the visual mock-up, as shown on the drawings. Mock-ups shall accurately represent job conditions, including glass, glazing, joints, sealants, anchors, and finishes. Provide at least one light of extra glass for each type and size on mock-up. The Material to be used in the visual mocks shall truly replicate the proposed finished installation, particularly in respect to finishes of metal work and glass.

    外幕墙承包商应提供所有建造如图纸所示的视觉模型的材料及人工。模型应能代表工程实际情况，包括玻璃，密封胶，接缝，挂码和完成

面。至少提供一片用于视觉模型的每种类型尺寸的玻璃。视觉模型中使用的材料应与实际效果一致，特别是金属的表面处理和玻璃

11. The Client Representative may require that the glass mock-up be installed on multiple elevations prior to final approval.

业主代表可能在最终批复前，需要玻璃样板安装在几个立面上

12. The External Facade Contractor should allow for all dismantling, demolition and removal and disposal of all materials and builders work on the visual mock ups.

外幕墙承包商应对视觉模型的拆卸、销毁、移除和处置所有材料

13. There shall be no failure or gross permanent distortion of anchors, frames, glass or panels, no gasket disengagement and no weather or structural sealant failures.

角码、框架、玻璃或面板应不能出现永久变形或损坏，胶条不能脱落，结构胶或耐候胶不能损坏。

T. Benchmark installations:
安装样板

Provide benchmark installations for each major type of Work to be incorporated in exterior wall construction at locations designated by the Consultant. Benchmark installations shall represent the primary types of materials and construction systems to be encountered in exterior wall Work. Installation shall comply with manufacturer's recommendations and actual proposed methods. Schedule the installations, with allowance for sufficient sealant curing time, so that samples may be examined and necessary adjustments made at least 1 week prior to date scheduled for commencing installation of the Work. Visually examine the benchmark installations for general workmanship and appearance. Conduct a water hose test on each benchmark installation in accordance with the test procedure outlined under Field water test.

在外幕墙施工阶段，应对每种主要墙型提供安装样板，位置由顾问指定。安装样板应反映外幕墙工作中所涉及的所有主要材料及施工系统。安装应与厂商建议及实际方法一致。应计划安装时间，以便给予密封胶足够的养护时间。所有样品应在安装前至少一周时间检验，以便有时间对其进行调整。视觉上的检查安装样板的施工工艺及外观效果。对每一个安装样板提供一个水喉喷淋测试，测试应与现场淋水测试程序一致。

Upon acceptance, the benchmark installation shall remain as a part of the installed permanent Work. If workmanship that falls below the accepted standard is rejected, the Contractor shall remove it and re-install it to the acceptable standard.

直到竣工验收，安装样板应保留并作为永久保留工作，如果施工工艺不能满足标准，将被驳回，承包商应拆除并重新安装直到满足标准。

1.13 FIELD TESTS ON ACTUAL BUILDING 现场测试

A. The Consultant shall designate a minimum of one area per wall type and special areas of completed work to be water tested up to a maximum of 15 separate locations on the building. The extent of each test area shall be designated by the

Consultant and shall be not less than three bays wide and two stories high. This testing shall be performed as early as practicable for each test area.

幕墙顾问应根据 ASTM E 1105 指定完工后每种墙型和特殊区域的测试区域。测试区域不能有无法控制的漏水的存在。（测试区域不能小于 3 块面板和 2 个楼层

B. The External Facade Contractor shall provide powered scaffold(s) to access test areas, hose, water supply and manpower to perform at least twelve successful tests, plus repeats of any unsuccessful tests.

外幕墙承包商应提供活动脚手架、水管、水源、及人力、进行至少 12 次成功的测试，及重复测试未成功测试。

C. Method for field water leakage tests, but not interpretation of results, shall conform to ASTM E 1105, except as modified herein. Operating doors and windows shall be tested in the same manner as fixed wall areas. Taping of exterior joints is not required. There shall be no unacceptable water leakage as defined herein.

除经特别指出，现场的漏水测试应依据 ASTM E 1105，但结果的评析则非依据该基准，活动窗门的测试应与固定墙的测试相同，外部接缝不可以用胶布密封，且不得发生本规范所定义的不容许漏水

D. The Consultant shall determine the necessity and scope of additional tests, depending upon the presence or absence of leakage in the initial tests. The External Façade Contractor shall perform any unsuccessful tests as specified, at no additional cost. Any corrective work required shall be the responsibility of the External Facade Contractor, along with the cost of retesting, and the costs incurred by the Client Representative. Remedial measures shall maintain all specified standards of quality and durability. All remedial proposals shall first be properly documented and submitted for approval. Remedial work shall only proceed upon Client Representative’s written approval of proposal.

依据初次测试中有无发生漏水现象，幕墙顾问决定是否应进行额外测试及其范围。承包商必须提供每种类型墙和转角至少一次成功的测试，并且重新测试任何不成功测试，同时，不能申请增加费用。任何补救工作由承包商承担，同时承包商要承担再次测试以及业主代表、业主、顾问出席测试的费用。整改工作的测试标准须遵从由业主代表确定的质量和耐久性标准。整改方案应按程序提交审核并存档，所有整改必须要求有业主代表的书面审核通过。

E. Verify during construction that water leakage and condensation are effectively collected and drained to the exterior. Test internal gutters in every floor by temporarily plugging weep holes and filling with water. After a minimum of fifteen (15) minutes, inspect for water leakage. Correct deficiencies and retest until successful. Remove weep hole plugs after testing. All gutters are to be clean and free of debris (ex. Stickers) prior to installing additional material that would prevent access at a later time.

施工过程中，应仔细观察所有外来渗漏水及墙体内部结露水是否完全排至外侧。并于每一层楼集水槽处施行防水测试，先将排水孔堵住，再装满水，至少维持 15 分钟，之后再观察是否有漏水现象。若有漏水，则须改善缺失后，再进行测试，直到合格为止。测试完成后须将排水孔清除干净。所有集水槽

在安装附件材料之前必须将杂物(比如标签)清理干净，否则会在以后影响正常排水功能。

1.14 DELIVERY, STORAGE, AND HANDLING 运送、储存及处理

A. All components of the wall shall be identified after fabrication by marks clearly indicating their location on the building as shown on the drawings.

本工程的所有构件皆应于制造后清楚标示其于建筑物上的位置

B. Storage on site shall be in a location and manner directed by the Main Contractor. Materials shall be stored so that they do not suffer any damage including damages arising from weather, soiling, wetting, or any other deleterious effect.

现场存放应限于总包方所指定的地点及方式，施工材料的储存应避免气候、潮湿及其它不利因素。

C. Packaging shall be in the minimum necessary to protect the parts from damage during shipping, hoisting, and storage

包装应符合防止材料因运送、吊装、及储存所造成损坏的最低包装需求.

D. Glass shall be protected from any possibility of water/condensation damage during shipping.

玻璃于运送期间，需提供保护避免水及湿气的破坏。

1.15 ENVIRONMENTAL REQUIREMENTS 施工环境要求

A. Do not install sealants when ambient temperature is less than 5°C, or when any other environmental conditions do not conform to manufacturer's specification.
当环境温度低于5°C或环境不符合密封胶制造上的规定时，不可进行密封胶的施工。

B. Maintain this minimum temperature during and after installation of sealants until sealants are fully cured or for the duration specified by the manufacturer.
密封胶施工时及施工后，须符合密封胶所需的温度、湿度及气候

C. External Facade Contractor acknowledges that the building location is in a climate that experiences a significant rainy season and will adjust their schedule accordingly and will take precautions during the installation to avoid any damage from rain or pooling water.
外幕墙承包商了解建筑所在地的气候条件及雨季，将会调整他们工期计划，以便预防在安装过程中避免大雨造成的任何损坏。

1.16 FIELD MEASUREMENTS 现场测量

Verify that field measurements are as indicated on shop drawings. External Facade Contractor is responsible for verifying all dimensions in field and for providing timely notification of any field conditions that are the work of others that may inhibit the installation of the work of this contract.

外幕墙承包商须自行确认现场测量所得的尺寸与图面尺寸是否相同，若发现现场尺寸不符，应及时通知相关工程单位解决，以免耽误本工程的进度

1.17 COORDINATION 协调

A. The work under this section shall be coordinated with related work of other trades, utility companies, etc., in a manner that ensures the steady progress of work under this contract.

本节工程应与其它相关工程互相协调，以确保本合约工程的稳定进展。

B. Scheduling.进度

1. External Facade Contractor shall prepare and maintain a detailed schedule of activities from the time of contract award until contract completion. Schedule coordinated submittals and shop drawings so the design team can make available the staff. Schedule shall indicate sequencing of all activities with duration of each including float where applicable. Schedule shall indicate sequencing with Others and as follows:

外幕墙承包商需准备和更新由发包至完工为止的各项工作进度表，并确实遵守，使得设计小组能够合理分配其工作。进度表需列出各项工作顺序及时间，如有其它变动因素，亦需一并列出。进度表各项工作顺序如下：

a. A technical submission dates for all materials and equipment including time for review and resubmission.

材料及设备技术资料送审日期及时间，需包含审核及再送审时间。

b. Ordering of materials and equipment dates.

材料及设备采购日期及时间。

c. Manufacture dates.

制造日期及时间。

d. Delivery of materials and equipment dates.

送货日期及时间。

e. Installation of systems and equipment indicating methods of installation.

系统及设备安装及施工安装方案。

f. All coordination activities for work provided by others with milestone dates including coordination with the Client Representative.
所有与他项工程协调的里程碑日期，包含与业主代表协调的日期及时间。

g. Key access and power-on dates, etc.

重要工作的开工日期。

h. Submissions to government and statutory bodies (including review time and possible resubmissions.)

政府部门及其它相关法定单位的送审日期及时间，需包含审核及再送审时间。

i. Inspection dates by government authorities and utility companies.

政府部门检验日期及时间。

j. Inspection period by Client Representative for acceptance of installation.

业主代表视察日期及时间。

k. Testing and commissioning.

测试日期及时间。

l. Construction phasing.

建造阶段日期及时间

2. The above list is indicative of activities to be included but not exhaustive of all requirements.
进度表至少需包含上述项目，其它必要项目亦需一并列出。

1.18 WARRANTY 保证

A. Unless stated otherwise in these specifications, the warranty shall state that all work is in accordance with the drawings and specifications, free from defects in materials, finish, and workmanship, and weather-tight for a period of fifteen (10) years from the date of Certificate of Practical Completion under the Main Contract by the Client Representative. External Facade Contractor shall agree to repair or replace defective materials and workmanship to "like new condition", including such exploratory work as necessary to determine the cause, during the guarantee period, at no additional cost to the Owner. All warranties to cover costs of "in place" replacement, not just delivery of defective materials to site.

除非本规范中另有规定，外幕墙承包商应于保证书中述明所有工程皆依照图式及规范进行施工，且于竣工验收后十年年内不出现材料、表面处理、工作质量及耐候缺陷。在保证期内，外幕墙承包商必需同意修复或更换有缺陷的材料，使其回复如新，且不得再向业主收费。所有质保包括现场更换费用，不是仅仅将更换材料运送到现场。

B. The warranty shall further state that glass shall be guaranteed against breakage due to defects in glass materials, fabrication of insulating units, and installation for a period of fifteen (10) years after acceptance of the work by the Client Representative. The External Facade Contractor shall include with his bid a copy of the proposed warranty.

外幕墙承包商工程保证书中亦应保证于竣工验收后10年内，玻璃不会因其材质不良、中空玻璃加工、或施工安装不良而造成破裂，外幕墙承包商应于投标时附缴拟订保证书。

C. Insulating glass units shall carry a fifteen (10) year warranty from their manufacturer against de-lamination, obstruction of vision by fogging up and collection of dust or dirt in the enclosed space or cracking, peeling or flaking of coating and/or frit as applicable and in a form acceptable to the Client Representative. External Facade Contractor shall include with his bid proposed copy of warranty from proposed glass manufacturer for each type of unit.

中空玻璃(Insulated Glass)应有制造商提供的竣工验收后最少10年保证，且不得发生剥离(Delamination)，由于雾气、灰尘造成中空部份清晰度不佳、破裂及保护膜剥落，外幕墙承包商应于投标时附缴拟订来自于玻璃制造商的保证书。

D. In addition, spandrel glass shall carry a fifteen (10) year warranty from their manufacturer against peeling or flaking of ceramic frit, in a form acceptable to the Client Representative. The External Facade Contractor shall include with his bid a copy of the warranty from the proposed glass manufacturer.

此外，窗间墙玻璃(Spandrel glass)应有制造商提供的最少10年质量保证，不得发生陶磁漆(Opacifier)剥落或刮伤的现象，其保证应为业主能接受的型式，外幕墙承包商应于投标时附缴拟订的来自于玻璃制造商的保证书。

E. In addition, silicone sealants shall carry a fifteen (10) year warranty from the sealant manufacturer against adhesive or cohesive failure or staining in a form acceptable to the Client Representative. The External Facade Contractor shall include with his bid a copy of the proposed warranty.

密封胶亦应有其制造商提供的最少10年质量保证，不得发生黏合、结合失效或沾污的现象，其保证应为业主、业主代表及顾问能接受的型式，外幕墙承包商应于投标时附缴拟订的保证书。

F. Defective materials and workmanship for these guarantee provisions are hereby defined to include, but not be limited to, evidence of the following:

上述保证中所指的材料及工作质量缺陷的定义如下，但不仅限于次：

1. Penetration of water into the building.

   建筑物内部漏水。

2. Air infiltration exceeding specified limits.

   漏气率超过指定极限。

3. Structural failure of components resulting from forces within specified limits.

   构件结构承受外来的作用力(小于设计应力)，而遭受破坏。

4. De-lamination of panels or insulating glass units

   面板或中空玻璃(Insulated Glass)发生剥离。

5. Discoloration, excessive fading, excessive non-uniformity, pitting, cracking, crazing, peeling, or corrosion

   褪色、过度变暗或不均匀、产生凹陷、破裂、剥落、或腐蚀

6. Glass breakage and glass corrosion.

   玻璃破裂及腐蚀。

7. Secondary glass damage and/or damage due to falling curtain wall components.

   次级玻璃损坏，或因幕墙构件脱落而导致损坏。

8. Adhesive or cohesive failure of sealant. Staining caused by sealant.

密封胶的黏合失效，或因密封胶而造成污损。

9. Crazing on surface of non-structural sealant.

   非结构性密封胶的表面龟裂。

10. Non-structural sealant hardening beyond Shore-A Durometer 50 or softening below 20.

    非结构性密封胶硬度超过50或低于20(Shore A硬度)。

11. Failure to fulfill other specified performance requirements. Failure of operating parts to function normally/ properly.

    未能符合其它指定的效能规定，推开门窗未能正常操作。

12. Insulated glass which experiences failure of the edge seal as defined herein shall be replaced at no charge (material and labor) for a minimum fifteen (10) year period beginning on the Date of Final Acceptance (Date of Final Acceptance).

    任何中空玻璃自验收日起10年内若发生合片胶开胶，承包商应负责免费更换(含材料及人工)。

13. Laminated glass, which delaminates, shall be replaced at no charge (material and labor) for a minimum fifteen (10) year period beginning on the Date of Final Acceptance

    任何夹胶玻璃自验收日起10年内若发生开胶，承包商应负责免费更换(含材料及人工)。

14. Fully tempered glass that breaks for any reason, including nickel sulfide inclusions shall be replaced (material and labor) for a minimum fifteen (10) year period beginning on the date of certificate of making good defects issued by the Client Representative under main contract.

    任何全钢化玻璃自验收日起10年内若无故发生破裂，包含硫化镍杂质，承包商应负责免费更换(含材料及人工)。

15. A reflective glass product whose reflective coating cracks, peels or discolors shall be replaced at no charge (material and labor) for a minimum fifteen (10) year period beginning on the date of certificate of making good defects issued by the Client Representative under main contract.

    任何反光玻璃的反光膜或陶磁漆，自验收日起10年内，若有任何龟裂、剥离或褪色时，承包商应负责免费更换(含材料及人工)。

16. A PVDF finish on aluminum which cracks, peels, fades in excess of specified limits or chalks in excess of specified limits shall be replaced at no charge (material and labor) for a minimum fifteen (20) year period beginning on the date of final acceptance.

    任何氟碳喷涂的铝型材表面，自验收日起20年内，若有裂缝、褪色、剥离现象，且上述该现象超出指定接受范围时，承包商应负责免费更换(包括材料及人工)。

17. A painted powder finish on aluminum which cracks, peels, fades in excess of specified limits or chalks in excess of specified limits shall be replaced

at no charge (material and labor) for a minimum fifteen (15) year period beginning on the date of final acceptance.

任何粉末喷涂的铝型材表面，自验收日起15年内，若有裂缝、褪色、剥离现象，且上述该现象超出指定接受范围时，承包商应负责免费更换(包括材料及人工)。

18. Failure of operating parts to function normally.

影响开启部分功能的损坏

19. Cracking, grazing, flaking of coatings or ceramic fritted glass.

镀膜玻璃或彩釉玻璃呈破裂、突起及雪花现象。

20. Rusting of stainless steel cladding.

不锈钢锈蚀。

21. Rusting of painted or galvanized steel support.

烤漆或镀锌钢支撑锈蚀。

G. The External Facade Contractor shall be responsible for damage to the building and furnishings occasioned by defective materials or workmanship or damage as part of repairs to the wall.

对于因材料或工作质量缺陷所致或因修复工作所造成的建筑物损坏，外幕墙承包商应予负责。

H. The warranty, the enforcement or lack thereof, shall not deprive the Client of other actions, rights, or remedies available to him. Warranty shall be in a form approved by Client Representative. Warranties do not cover damage resulting from vandalism or acts of nature exceeding performance criteria.

工程保证书本身不可限制业主采取其它行动或修复的权力。保证书的形式应为业主所核准，工程保证书不须涵盖因暴动或天灾等超过效能准则以外因素所导致的损害。

The terms below used in conjunction with finished warranty are defined as follows:
与表面处理保证相关的用语定义如下：

1. "Excessive fading": means a change in appearance which is perceptible and objectionable as determined by the Client Representative when viewed visually in comparison with the original color range samples.

过度褪色：业主代表认定材料外观与原来样品的色泽范围相比较，觉得有明显的变化。

2. "Excessive non-uniformity": means non-uniform fading during the period of the guarantee to the extent that adjacent parts have a color difference greater than the original color range as set by Client Representative.
过度不均匀：在保证期内发生不均匀褪色，而与邻近材质颜色的差异超过原先业主代表核准的色泽范围。

3. "Pitting or corrosion": means there shall be no pitting or other type of corrosion discernible from a distance of three (3) meters, resulting from the natural elements in the atmosphere at the project site.

凹痕或腐蚀：在 3 米以外审视，不得有因大气中自然成分而造成表面材质的凹痕或其它类型的腐蚀。

PART 2 – PRODUCTS

第二部分 – 材料

2.01 MANUFACTURERS 制造商

A. Aluminum extrusion manufacturers for aluminum extrusion must possess five (5) years experience or better in the curtain wall extrusion and fabrication business.

铝型材制造商应在幕墙的铝型材生产及加工业务上，拥有5年以上的经验。

B. Manufacturers for architectural aluminum panels must possess five (5) years or better in the fabrication and finishing of the panels. An equal manufacturer can be submitted for approval by the Client Representative in accordance with Article 1.08 - Paragraph I.

铝墙板制造商应在铝墙板的加工及表面处理业务上，拥有5年以上的经验。任何同级厂商皆须经业主代表认可且符合1.08I。

C. Manufacturers for architectural panels and sheet metal plate and bar stock must possess five (5) years or better in the fabrication and finishing of the panels. An equal manufacture can be submitted for approval by the Client Representative in accordance with Article 1.08 - Paragraph I.

建筑板材、金属板制造商应在铝墙板的加工及表面处理业务上，拥有5年以上的经验。任何同级厂商皆须经业主代表认可且符合1.08I。

2.02 MATERIALS 材料

A. Aluminum
铝材

1. The following alloy and temper combinations are acceptable for extrusions, subject to fabrication, finish, and performance requirements: 6063-T5; 6063-T6; 6105-T5; 6061-T6. Standard alloys shall conform to standards and designations of AA ASD1. Other alloys of the 6XXX series may be submitted for approval. Provide thickness as necessary to comply with performance requirements, but not less than the following:

   以下的合金种类及硬度的组合如符合加工、表面处理及性能要求的规定，则可用于铝挤型：6063-T5；6063-T6；6105-T5；6061-T6。其它6XXX系列的合金亦可送审供核准，但须提供足以符合性能要求的厚度，且不得低于下列要求：

   a. Principle extrusions: 1/8” (3.0mm)

      主要铝型材：3.0 mm。

   b. Snap type glazing stops and non-supporting trim members: 1/16” (1.5mm).

玻璃周边的盖板及非支撑性镶边饰条：1.5mm

c. All aluminum extrusions shall be of architectural quality, tolerances shall be a minimum of one half commercial tolerances as set by the Aluminum Association. Extrusions shall conform to ASTM B 221/B221 M.

所有铝型材须为建筑用品质，其容许误差仅可为美国铝料协会(The Aluminum Association)普通容许误差的一半。型材需达到ASTM B 221/B221 M.的要求。

d. Submit all extrusion shape drawings for record indicating minimum wall thickness in compliance with the above.

送审所有的铝型材形状图纸以供记录，显示的最小墙厚度须与上述的相一致

2. Sheet and Plate shall conform to ASTM B 209/B 209 M. The following alloy and temper combinations are acceptable for sheet and plate subject to fabrication, finish, and performance requirements: 3003-H14, 5005-H14. Other alloys of the 3XXX, 5XXX or 6XXX series may be substituted forapproval. Provide thickness as necessary to comply with performance requirements, but not less than the following:

以下的合金种类及硬度的组合如符合加工、表面处理及性能要求的规定，即可用为铝板及铝片：3003-H14，5005-H14。其它3xxx, 5xxx 或6xxx系列的合金亦可送审供核准。铝板及铝片须符合ASTM B 209的要求。提供足以符合性能要求的厚度，但不得低于下列要求：

a. Members formed from sheet: 1/8” (3.175mm)

铝板成形的构件：3.175mm。

b. Panels: 1/8” (3mm), minimum, unless otherwise designated on the Architectural drawings. Provide stiffeners as required to maintain an out-of-level flatness not to exceed 0.1 percent or 1/16” in 5’-0” (1.5mm in 1.5 meters), whichever is less. Panels for canopy soffit and facias shall be 3mm in thickness.

铝板：除非建筑图纸特别要求，铝板为1/8” (3mm)。根据要求使用加强措施保证铝板外部平整度不大于0.1%或1/16” 在 5’-0”内(1.5mm 在1.5 meters内) ，并以较小值为准。雨蓬吊顶板和立面板厚度应为3mm

c. Copings 1/8” (3.0mm) minimum thickness.

盖板：最小3.0mm。

B. Metal back panel at aluminum panels.
铝墙板的背衬金属板

1. Metal face sheet to provide watertight barrier, resistance to corrosion, rusting, pitting, flanking or peeling.

金属面板必须提供防水、抗腐蚀、防锈、凹陷及剥落等功能。

2. Minimum thickness Ga.16 (1.5mm) panel shall meet the performance and testing requirements of Article 1.07 of this specification.

面板的最小厚度为1.5mm，且应符合条款1.07中性能与测试的要求。

3. Galvanized sheet, conforming to ASTM A653/A 653M, G90 coating.

镀锌铁板应符合ASTM A 653/A 653M、G90的涂膜要求。

C. Metal Back Panel at Shadow Box.
背衬箱处的铝背衬板

1. All the metal back panels at shadow box shall be 2.5mm aluminum sheet.

所有背衬箱处的铝背衬板皆须为厚度2.5mm厚铝板

D. Steel
钢材

1. All steel inboard weather line shall be hot-dipped galvanized unless identified on the tender documents. All steel outboard of weather line shall be stainless steel except where identified on the tender documents and in accordance with Article 2.02 Paragraph D.2 and Specification for Structural Steelwork by Structural Engineer. Where identified on drawings, architecturally exposed exterior steel may be hot-dipped galvanized and painted in accordance with Article 2.02 Paragraph H and Specification for Structural Steelwork by Structural Engineer.

2. Hot rolled shapes, plates, and bars - ASTM A36/A36M/ GB/T 700

热轧成型钢板及钢条- ASTMA36/GB/T 700/ GB/T 700

Sheet and strip, cold rolled (Grades A through E) - ASTM A 1008/GB/T-1591

冷轧钢片及钢带(A级至E级) - ASTM A1008/GB/T-1591

Sheet and strip, hot rolled (Grades A through E) - ASTM A1011/A1011 M/GB/T 912

热轧钢片及钢带(A级至E级) - ASTM A1011/GB/T 912

Sheet, hot-dipped galvanized (Grades A through F) - ASTM A 653/A 653M/GB/T 2518

热浸镀锌钢板(A级至F级) - ASTM A653/GB/T 2518

Structural tubing, hot-formed, welded and seamless - ASTM A618/A618M/GB/T 8162.

热成型，焊接及无缝结构钢管- ASTM A618/GB/T 8162

3. All steel inboard weather line shall be hot-dipped galvanized.

所有在防水层内的补强钢材，必须经过热浸镀锌处理

4. Aluminized steel sheet: conforms to ASTM A 463/A 463 M, coating T1-40.

铝钢板须符合ASTM A 463，T1-40的涂膜要求

5. Galvanized steel sheet: conforms to ASTM A 792/A 792M, coating AZ 50.

镀锌钢板须符合ASTM A 792，AZ 50的涂膜要求。

6. Hot-dip galvanized zinc coatings on steel: conforms to ASTM A 123.

钢结构上的热浸镀锌，应符合ASTM A 123

Note: All materials should comply with the equivalent grade according to the relevant British standard or EN standard.

注意：所有材料应符合或同等级的英标或欧洲标准。

E. Stainless steel
不锈钢

1. General:

一般规定

a. Provide sheet metal plate and bar stock selected or surface flatness, smoothness, and freedom from surface blemishes where exposed to view in the finished unit. Do not use materials with pitting, seam marks, roller marks, and variations in flatness exceeding those permitted by referenced standards for stretcher-leveled metal sheet, strains, discoloration, or other imperfections.

应选用表面平整光滑，无表面缺陷的外露金属面板和钢条。不可使用有凹陷、裂纹或平整度超过规范容许范围，变形、褪色或有其它瑕疵的钢材

b. Exterior applications: sheet, strip, plate, and flat bar and extrusions, (AISI 316 Grades A through D), ASTM A666 GB/T 1220 GB/T 3280, GB/T 4226, GB/T 4237 and GB/T 8165.

室外及室内应用：钢片、钢带、钢板、平钢条及型材(AISI 316，A级至D级)─ASTM A 666/GB/T 1220， GB/T 3280，GB/T 4226，GB/T 4237，以及GB/T 8165等规范的标准.

Exterior: SS 316
室外：SS 316

Interior: SS 304
室内：SS 304

At Swimming Pool: SUS 444
游泳池区域：SUS 444

2. Stainless Steel Sheet:

不锈钢板

a. Unless otherwise identified herein or on drawings, stainless steel sheet shall be brake formed with V-cut corners.

除非规范或图面特别说明，在不锈钢板折弯成型的前，应在折弯处的背面刨沟(V-cut corners)。

b. Minimum sheet thickness is Ga.14 (2mm) for all panels, frame cladding, fascias and soffits. Trim shall be Ga.16 (1.5mm) thickness unless otherwise designated on the Architectural drawings.

除非建筑图面特别说明，所有面板、框架包板、饰带及吊顶天花板，其厚度最少须为2mm；条饰厚度最少须为1.5mm

c. Performance requirement: Variations in flatness shall not exceed 0.1 percent or 1/16” in 5’-0” (1.5 mm in 1.5 meters), whichever is less. Increase metal thickness, provide stiffeners, or both, as required to meet this requirement.
性能要求：平整度要求为在1.5m内不得超过1.5mm或0.1%。如有需要时，可增加金属厚度或提供补强料，或两者同时进行以达到此要求

3. Finishes:

表面处理

Refer to Architectural Material List

参看建筑师材料表

F. Fasteners, Connectors and Anchors.
固定件、连接件及锚钉

1. Provide fasteners as specified in paragraph entitled “Fastener Metals for Joining Various Metal Combinations” in “Part 2- Products” of AAMA MCWM-1. Metals used for fasteners shall be chemically and galvanically compatible with contiguous materials.
如AAMA MCWM-1在@-材料部分开头为“Fastener Metals for Joining Various Metal Combinations” 中详细说明的提供固定件。用于做固定件的金属须与周边的材料在化学性能和电流方面相兼容

2. Fastener requirements listed are applicable to screws, bolts, washers, nuts, rivets, and pins. (All fasteners should be stainless steel type 316（316-08）.)
所有固定件的规定适用于螺丝、螺栓、垫圈、螺帽、铆钉、及插梢（所有固定件皆应为316（316-08）型不锈钢）

3. All self-drilling/self-tapping fasteners ('Teks') shall be 'Dril-flex' with Stalgard finish, manufactured by ELCO Industries, Rockford, Illinois or equivalent and endorsed by the Architect in accordance with Article 1.08-Paragraph I.
所有自攻型固定件，由ELCO Industries,Rockford,Illinois 或同级厂商生产生产的‘Teks’产品，表面处理为Stalguard的"Dril-Flex"产品，或经核准符合本规范条款1.08.I的同级品

4. At all connections subject to movement, separate all adjacent moving surfaces with friction-reducing pads (graphite impregnated nylon, or equivalent and endorsed by the Architect). Pads shall not be lessthan 3.2mm thick and positively held in place (open end slots are not acceptable). Fasteners at moving connections shall be tightened snug and then backed off one-half turn or as specifically recommended by fastener manufacturer for moving connections. Nut shall be a self-locking type.
在所有可移动的连接处，皆应以减少摩擦的垫片分离其接触面(如以渗石墨的尼龙，或经核准的同级品)，垫片的厚度不应小于3.2mm，并应

能于其位置上妥善固定(马蹄形垫片不得使用)。可动连接部的固定件应适切旋紧后，再回旋半圈，最好由固定件生产商推荐指定。螺帽应为自锁式(Self-locking type)

5. Shim stacks at fasteners transferring shear forces shall not exceed 2 times the fastener diameter or 4 shims in height unless the shims are steel, welded together, and the fastener clearance hole is not greater than fastener diameter plus 0.8 mm.
传递剪切力的紧固件垫片叠加不能超过2倍的紧固件直径或4个垫片的高度，除非是钢垫片焊接在一起，且孔径不大于紧固件直径0.8 mm以上

6. Miscellaneous anchorage devices and support brackets shall be of sufficient thickness to meet the performance criteria, but not less than 12 gauge (2.5 mm).
各类锚接装置及支撑托架应具足够厚度，以符合其效能准则，但不得小于12 gauge(2.5mm)。

G. Finishes - Aluminum.
表面处理-铝材

Aluminum finish color and appearance shall match that of the sample approved for use in the project within the aluminum producer's standard color range.
铝型材表面颜色和处理方式应在铝材制造商标准色卡范围内经过批准作为本工程的样本一致

1. Fluorocarbon finish or equivalent and endorsed by the Architect.
氟碳喷涂完成面或其它类似完成面应得到建筑师认可

2. Aluminum Surfaces Exposed to Outdoor View.
室外外露可见的铝表面

a. All aluminum surfaces exposed to view under outdoor circumstances shall receive a factory applied, oven-cured three coat two bake finish, based on Kynar 500 or Hylar 5000 70% fluoropolymer resin and supplied by one of their licensed formulators. The licensed formulator shall certify in writing to the Architect prior to painting, that the finish he supplies will meet the minimal requirements for formulation as set forth in the licensing agreement.

所有室外可见的铝表面皆应于工厂内完成三涂两烤的喷涂，所用的材料表面处理应采用由其授权的配制厂所供应的 Kynar 500 或 Hylar 5000 70%氟化聚合物树脂。在喷涂前书面授权证明须提供至建筑师处。书面授权书是能成为供货商的基本条件。

b. The PVDF finish should be three coat (metallic/micaflake)/four coat or two coat (solid), depending on the selection of Architect's finishes, two bake system. Total dry film thickness shall be assessed utilizing ASTM D1400 method. Eighty percent of measurements on primary exposed surfaces shall meet or exceed 30 microns (1.2 mil).

PVDF 表面处理应为三涂（金属/云母片）/四涂或两涂（固态），根据建筑师的表面处理选择，两烤系统。总干膜厚度应通过 ASTM

D1400 进行评估。底漆外露面的 80%的尺寸应达到或超过 30 微米（1.2 密耳）。

Two coat system:	Primer	- 5 to 10 microns
两涂系统：	底漆	- 5 to 10 微米
	Topcoat	- 25 to 30 microns
	面漆	- 25 to 30 微米
Three coat system:	Primer	- 5 to 10 microns
三涂系统：	底漆	- 5 to 10 微米
	Topcoat	- 25 to 30 microns
	面漆	- 25 to 30 微米
	Clear	- 10 to 20 microns
	清面	- 8 to 10 微米
Four coat system:	Primer	- 5 to 10 microns
四涂系统：	底漆	- 5 to 10 微米
	Barrier Coat	- 25 to 30 microns
	防渗漆	- 25 to 30 微米
	Topcoat	- 25 to 30 microns
	面漆	- 25 微米
	Clearcoat	- 10 to 20 microns
	清面漆	- 10 to 20 微米

c. Recessed, unexposed areas such as inside corners and channels shall be visually covered to the extent possible.

凹处、不暴露处，比如内角和槽等处也需喷涂以便遮挡所有可见表面。

d. Aluminum is often finished in lengths prior to cutting and fabrication. The External Facade Contractor shall ensure that cut edges are of good edge quality with the use of proper machining equipment. Cut edges when exposed to outside environment shall be treated or sealed to prevent any cut edge corrosion to the coating.

铝型材通常在切割加工前已经表面处理。外幕墙承包商须采用合适的加工设备以保证切割边缘状态良好。因切割而外露的边缘需要处理或密封以避免损伤漆层

e. Coatings shall be visibly free from flow lines, streaks, blisters or other surface imperfections in the dry-film state on exposed surfaces when observed at a distance of 3 m from the metal surface and inspected at an angle of 90 degrees to the surface.

在距离金属表面 3 米，与表面形成 90 度角观察时，在视觉上外露面干膜涂层应没有线痕、划伤、气泡等表面损坏现象。

f. The paint finish shall meet or exceed AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

表面烤漆须符合或超过AAMA 2605－ “高效能有机涂料使用于铝型材及面板”的非强制性规范说明、性能要求以及测试步骤的规定

g. Cleaning and substrate preparation shall be in compliance to Section 6 of AAMA 2605.

清洁及基片预加工应遵照 AAMA 2605 第六章规定。

h. Finishes 表面处理:

Refer to Architectural Material List

参看建筑师材料表

3. Aluminum Surfaces Exposed to Indoor View

室内外露可见的铝表面

a. All aluminum surfaces exposed to view under indoor circumstances shall receive a factory applied, oven-cured powder coating.

室内外露铝型材表面部位应在工厂内进行粉末喷涂处理

b. The total dry film thickness shall range 60 to 80 microns.

干膜总厚度应为60到80微米。

c. Recessed, unexposed areas such as inside corners and channels shall be visually covered to the extent possible.

凹处、不暴露处，比如内角和槽等处也需喷涂以便遮挡所有可见表面

d. Finish shall be applied by an applicator licensed by the formulator and applied in strict conformance with their specification for cleaning, priming, finish coat application and quality control. Applicator shall provide written certification of applicator license to Architect by a formulator for approval prior to application of the finish.

表面烤漆应由获得配制厂授权的涂装厂进行烤漆，且需严格遵守清洁、打底、涂料、及质量控制各方面的要求。涂装厂须于进行喷涂前向业主代表/顾问提供由配制厂颁发的授权证明

e. The paint finish shall meet or exceed AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Pigmented Organic Coatings on Aluminum Extrusions and Panels.

表面烤漆须符合或超过AAMA 2604－ “有机涂料使用于铝型材及面板”的非强制性规范说明、性能要求以及测试步骤的规定

f. Finishes 表面处理:

Refer to Architectural Material List

参看建筑师材料表

4. Color variation between adjacent parts of the same finish shall be imperceptible to the naked eye under normal daylight conditions. The External Facade Contractor shall submit range samples that define the maximum variation of color that can be anticipated in the work for approval by the Architect.

   相邻构件的颜色差异在正常日光状况下，应为肉眼所无法察觉。外幕墙承包商应送审适用于本工程并能涵盖颜色的最大变化范围的色板样品给业主代表以供批准。

5. The External Facade Contractor shall establish and submit for approval a quality control program to assure compliance with the specified requirements. The program shall include documented procedures, processes, testing, etc. External Facade Contractor shall maintain complete certified inspection, testing and process records. Said records shall be available to the Client representative and Owner. No finishing shall be performed prior to approval of this quality control program.

   外幕墙承包商应建立一套质量控制计划，并予送审，以确定是否能符合指定的要求。计划应包括明定的程序、步骤、测试等等。外幕墙承包商须保存完整的检验、测试及程序的记录。此记录应能保证业主代表及顾问能随时得到。在此质量控制计划未获得核准的前，不应进行表面处理

6. The External Facade Contractor shall not ship any material that has not been inspected and tested in the prescribed manner and does not fall within the prescribed color range, or has been rejected by the Architect.

   外幕墙承包商不准运送任何未依规定检验及测试的材料，亦不应运送任何色泽范围以外，或遭业主代表否决的材料

7. Field touch-up of painted aluminum components shall only be performed with written approval from the Architect. Only “air dry” system is allowed, and

   铝材的现场补漆必需获有业主代表的书面许可。现场补漆只能使用“自然风干”方式，具体如下

   a. Field touch-up materials and procedures shall be performed in strict accordance with paint manufacturer’s written instructions.

      现场补漆需严格按照涂料生产商的书面指示进行

   b. Damaged material as determined by the Architect shall be replaced with new material.

      业主代表认为受损的材料皆应换新

   c. External Facade Contractor shall perform a sample repair as instructed by the Architect and shall not proceed until the sample is approved for workmanship and color uniformity.

      外幕墙承包商需依业主代表指示提供样品，在样品的工艺及颜色统一核准前，不得进行现场补漆

H. Finish for Exterior and Interior Steel Elements

室外及室内钢构件的表面处理

1. Architecturally exposed exterior and interior galvanized steel to receive a Three-coat system as manufactured by Jotun or equivalent and endorsed by the Architect in accordance with Article 1.08 Paragraph J. Finishes for exterior and interior elements to take into consideration of fire rating as appropriate. Finishes shall be shop applied.

   建筑室外和室内暴露的镀锌钢材表面均应采用Jotun或根据第 1.08条J条文要求的同等厂家生产的三涂处理。室内外钢材表面处理应考虑相关的防火率要求。所有表面处理均应在厂内进行。

2. The Three-coat system shall be applied as per manufacturer's recommendation as follows:

   表面三层涂装需依制造商的以下指示进行

   a. Surface preparation of steel to be as per SSPC-SP6 & ISO 8503-2:2012& GB 30790.

      钢料构件的表面准备工作须符合 SSPC-SP6& ISO 8503-2:2012& GB 30790。

      Sandblasting to Sa 2 ½（ISO 8501-1:2007）very through sand blasting clean，view with magnify, surface shall free of visible oil, grease, mill scale, rust, paint and foreign matters. Surface profile in range of 30-85microns （ISO 8503-2:2012）
      表面处理需喷砂处理至 Sa 2 ½（ISO 8501-1:2007） 非常彻底的喷射处理，在不放大的情况下进行观察时，表面应无可见的油脂和污垢，并且没有氧化皮、铁锈、油漆涂层和异物。粗糙度应满足 Ry5 30-85 微米（ISO 8503-2:2012）。

Coating system 涂料系统	Product Type & Names 产品类型及名称		NDFT, µm 干膜厚度
Primer 底漆	Zinc Rich Epoxy 环氧富锌底漆	Barrier 80	60
Intermediate 中间漆	Fast Drying Epoxy MIO 快干环氧中间漆	Penguard Midcoat M20	120
Topcoat 面漆	Polyurethane 聚氨酯面漆	Hardtop	60

3. Over spray is to be avoided to ensure a smooth finish and all sides need to be coated simultaneously.

   为确保完成面平滑，不可过度喷涂，且所有表面必须同时喷涂。

4. Finish shall be applied by an applicator licensed by the formulator and applied in strict conformance with their specification for cleaning, priming, finish coat application and quality control. Applicator shall provide the Client Representative a notice of approval from the formulator prior to the application of the finish.

   表面涂装应由获得配制厂授权的涂装厂进行涂装，且需严格遵守清洁、打底、涂料、及质量控制各方面要求。涂装厂须于进行喷涂前，向业主代表提供由配制厂颁发的授权证明。

5. Warranty of the paint system against peeling, cracking, colour fading and the like shall be provided.

   防止涂层脱落、破裂、退色和其它类似情况应提供质保书予以说明。

6. Color variation between adjacent parts of the same finish shall be imperceptible to the naked eye under normal daylight conditions. The External Façade Contractor shall submit range samples that define the maximum variation of color that can be anticipated in the work for approval by the Architect.

   在正常日光状况下，肉眼应无法查觉相邻构件的颜色差异。幕墙分包商应提交色板样品予建筑师审批，样品须涵盖预期工程中会使用的颜色之最大变化范围。

7. The External Facade Contractor shall establish and submit for approval a quality control program to assure compliance with the specified requirements. The program shall include documented procedures, processes, etc. The External Façade Contractor shall maintain complete certified inspection, testing and process records. Said records shall be available to the Architect. No finishing shall be performed prior to approval of this quality control program.

   外幕墙承包商应建立一套质量控制计划，并予送审，以确定是否能符合指定的要求。计划应包括明定的程序、步骤等等。外幕墙承包商须保存完整的检验、测试及程序的记录。此记录应能保证建筑师能随时得到。在此质量控制计划未获得核准的前，不应进行表面处理。

8. The External Facade Contractor shall not ship any material that has not been inspected and tested in the prescribed manner, does not fall within the prescribed color range, or has been rejected by the Architect/Client Representative.

   外幕墙承包商不准运送任何未依规定检验及测试的材料，亦不应运送任何色泽范围以外，或遭建筑师/业主代表否决的材料。

9. Field touch-up of painted steel is permitted only with written permission from the Architect. Only “air dry” system is allowed, and

   钢材的现场补漆必需获有建筑师的书面许可。现场补漆只能使用“自然风干”方式，并且：

   a. Field touch-up materials and procedures shall be performed in strict accordance with paint manufacturer’s written instructions.
      现场补漆需严格按照涂料生产商的书面指示进行。

   b. Damaged material as determined by the Architect shall be replaced with new material.
      依照建筑师的意见，所有受损材料应该以新的材料替换。

   c. The External Facade Contractor shall perform a sample repair as instructed by the Architect and shall not proceed until the sample is approved for workmanship and colour uniformity.
      外幕墙承包商需依建筑师指示提供样品，在样品的工艺及颜色统一核准前，不得进行现场补漆。

10. The External Facade Contractor and/or the Glass Wall Contractor shall ensure that full co-ordination with the Structural Steel Contractor is executed, and shall have an alternate paint system (fire, as well as corrosion, protection etc) be proposed to respective steel works by either, or both, sub-contractors and the proponent(s) who shall be responsible for carrying out paint system compatibility tests.

外幕墙承包商及/或玻璃墙承包商须保证全面配合钢结构承包商，并且应分别提出钢结构工程的油漆系统（防火、防腐及防护等）的备用方案。提出方案方应负责进行油漆系统的兼容性试验。

2.03 COMPONENTS 构件

A. Thermal insulation
保温棉

1. Provide thermal insulation at spandrel glass and other non-vision areas.
窗间墙玻璃及所有非可视区域应提供保温棉。

2. Performance requirements:
性能要求：

a. minimum thickness: 100 mm

最小厚度：100 mm

b. Thermal Conductivity (25°C): not over [0.038] W/mk
导热系数 (25°C)：不大于[0.038] W/mk

c. Density : 80 kg/m^3
密度 80 kg/m^3

d. The reinforced aluminum foil has to have minimum 2000 pinholes per square foot for ventilation. The perimeter of the installed insulation shall be foil taped with reinforced aluminum foil.
保温棉须带有每平方英尺至少含 2000 个钉孔的铝箔，以利透气。保温棉四周需用铝箔胶带密封。

e. Fire rating, flame spread rating and non-combustibility as per Article 1.07 Paragraph K.

防火等级、火焰蔓延及不燃性应符合本规范条款 1.07.K 的规定

3. Acceptable products: “Rockwool” or equivalent and endorsed by the Architect in accordance with Article 1.08.I.
合格的保温棉：须为"Rockwool"或符合本规范条款 1.08.I 规定的同级品。

4. Seal joints in vapor barrier, and any punctures or tears in vapor barrier, with aluminum foil tape.
所有水汽阻隔屏障的接缝和任何裂缝处，必须以铝箔胶带密封。

5. Insulation shall be retained by aluminum clips, aluminum straps, galvanized steel straps, and pins with retaining disks or integral pockets within the unit frames. Maximum spacing of clips and straps shall be 400 mm c/c welded or glued. Maintain 15mm nominal air space between

insulation and glass. Insulation shall be retained so as to not be able to touch exterior glass or aluminum panel.
保温棉应以铝夹、铝条或镀锌钢条或铝挤槽固定于窗框周围。铝夹及铝条的最大间隔为 400mm （中心间距）。铝夹及铝条应焊接或粘贴。隔热材及玻璃之间应维持 15mm 以上的空气间隙。保温棉应予固定，且不可与外部玻璃或铝板直接接触。

6. Where thermal insulation is unbraced, brace insulation where it contacts safing, to prevent bow of insulation from pressure exerted by safing.
保温棉处若须塞置防火棉时，则须于保温棉的外侧放置补强料，以避免塞置层间塞时，导致保温棉凸出变形。

B. Fire Safing Insulation
防火棉

1. Completely fill voids at floor slabs and roof edges with mineral wool fire-safing insulation.

用矿棉做为填充物彻底填满楼层板和盖板边缘之间的所有空隙。

a. Minimum thickness: 200 mm (top to bottom)

最小厚度：200 mm（顶部到底部）

b. Width: 25% greater than slab edge opening to provide compression fit.

宽度：25%或更大的楼板边缘压缩率。

c. Thermal Conductivity (25°C): not over [0.038] W/mk

导热系数 (25°C)：不大于[0.038] W/mk

d. Minimum K-Value: 0.25Btu·in/ ft2·hr·°F = 0.036W/ m·K

最小 K 值：0.25Btu·in/ ft2·hr·°F = 0.036W/ m·K

e. Density : 110 kg/m^3

密度：110kg/m^3

2. Acceptable products: " Rockwool " or equivalent and endorsed by the Architect in accordance with Article 1.08 - Paragraph I.

可接受的产品：Rockwool或由建筑师根据第1.08条I段选定的同等级产品

3. Provide impaling clips configured as per safing insulation manufacturer's published literature except as noted herein. Clips shall be 1.5 mm thick galvanized steel and spaced at maximum 300 mm c/c. There shall be a minimum of two clips provided along the span of the void to be filled with safing. Clips shall be fastened to floor slab.

除非特别说明，须依制造商的文件以镀锌支撑夹固定层间塞。为了安全考虑层间塞最少要用两个夹子进行固定。镀锌支撑夹厚度最小为 1.5mm，间距 300mm，且必须固定于楼板。

4. Provide additional support in the form of 1.5mm galvanized steel clips that extend within 25mm of the back of curtain wall at conditions where dimension from floor to slab insulation exceeds 125mm. Clips to be spaced not greater than 600mm on center and not less than two clips must be used on each safing section.

   在楼板与隔热材的距离超过 125mm 的情况下，在幕墙後方 25mm 内提供 1.5mm 厚的镀锌钢支撑夹作额外的支撑。支撑夹的间距不应大於 600mm，并且每一个防火材部分必须至少要使用两个支撑夹。

5. Alternative safing design must be provided where the dimension from face of floor slab to back of curtain wall exceeds the width of the tested assembly. Alternative must satisfy the same performance requirements as the specified system and meet local building authority requirements.

   若楼板边缘至隔热材的距离超过测试样品提供的层间塞宽度时，必须提供其它层间塞的设计。重新设计层间塞的性能，必须符合原先规范及地方建筑权威部门的要求。

C. Fire Stop/Smoke Seal
防火/防烟密封胶

1. Provide continuous smoke seal as part of Fire Safing assembly to prevent the passage of smoke between all compartments separated by fire safing assembly.
   施打连续的防烟密封胶于层间塞上方，此防烟密封胶视为层间塞的一部分，防止烟渗透。

2. Performance requirements:
   性能要求

   a. The product shall have “China's national mandatory product certification” issued by the ministry of public security fire proof product conformity assessment center, and provide test report which satisfy to GB 23864.
      产品须具有公安部消防产品合格评定中心颁发的“中国国家强制性产品认证证书”，且需提供满足 GB 23864 标准的测试报告。

   b. Applied by professional spray equipment, the spray-finish thickness should be no less than 3mm, and dry finish thickness should be no less than 1.5mm.
      需用专业的喷涂设备施工，喷涂厚度须不小于 3mm，干燥后的厚度不小于 1.5mm。

   c. Continuous and smoke-tight completely, and provide test report of smock seal performance.
      须连续并完全不透烟，需提供密烟性能检测报告。

   d. Have sufficient expansion flexibility (no less than ± 50%) to allow all anticipated movements in wall system and remains intact, and provide relative test report.

需具备足够的伸缩变形能力（不小于± 50%）以满足因幕墙系统位移而产生的变形要求，并保持完好不出现裂缝，需提供相应检测报告。

e. To meet codes and local standard FRP Requirements. Long-term fire effectiveness and durability should be no less than 30 years, and provide relative test report.
产品需符合规范及当地的防火要求。长期防火有效性与耐久性不应小于 30 年，需提供相应检测报告；

f. Shall be acoustic insulation and waterproof, and provide relative test report.
需具备隔音及防水性能，需提供相应检测报告。

3. Acceptable products: STI Spray, Hilti CP672, or approved equivalent and endorsed by the Architect in accordance with Article 1.08.I.
合格的材料：STI Spray, Hilti CP672，或符合本规范条款 1.08.I 规定的建筑师核准的同级品。

D. Sealant Backer Rod
填缝材的背衬材料

1. Performance requirements:
性能要求：

g. Closed cell polyethylene backer rod
聚乙烯蜂窝背衬材料。

h. Compatible with all sealants.
与所有密封胶兼容。

i. Does not absorb water and is non-gassing when punctured when tested in accordance with ASTM C1253.
背衬材料须为不吸水，刺破时不产生气体，且符合 ASTM C 1253 的规定。

2. Acceptable Products: Sofrod by Nomaco or approved equivalent in accordance with Article 1.08- Paragraph I.

背衬材料须为’Sofrod by Nomaco’或符合本规范条款 1.08.I 规定的同级品

E. Air seals
气密材

Soft density neoprene closed cell sponge.
气密材为柔软密度闭口(Closed Cell)氯丁橡胶(Neoprene)泡绵。

F. Weep baffles.
排水泡绵

45 PPI reticulated PVC coated open cell urethane foam. Compressed 30-40% min., with aluminum baffle covers.
以 PVC 处理过且为 45 PPI 的排水带蜂巢孔的聚氨酯泡绵，压缩率最小在 30-40%间，应塞入排水孔内。

G. Seismic Joints
抗震缝

1. Type ‘A’ “SF-Series” by Construction Specialties, Inc. or approved equal. Custom color extruded Csprene 303 silicone at visible primary seal at interior and exterior gaskets and standard black color at non-visible secondary seals at walls. Pantographic wind load support mechanisms should be included for joints 12" and larger. All miters and changes in direction to be factory fabricated, heat welded transitions.
A 类型，由专业施工单位（或经核准的同等级品牌）提供的 SF 系列。室内和室外可见第一道密封条使用定制颜色的硅胶型填縫剂 Csprene 303，墙体的不可见部位的第二道封条使用黑色。接缝 12"或更大处应包含缩放风荷载支撑机械。方向上的斜接及更改应在工厂加工完成，并进行热焊接过渡。

2. Type ‘B’ “BRJ-Series” by Construction Specialist, Inc. or approved equal Flexible membrane cover Type E-60 mil EPDM sheet color white or black with stainless steel 0.018 inches (0.46 mm) and 4 inches (100 mm) wide flanges at roofs (horizontal surface)/canopies/etc. All end caps, transitions and miters to be factory fabricated to ensure water integrity.
类型 B，专业施工单位（或经核准的同等级品牌）生产的 BRJ-系列，用 0.018 英寸（0.46 毫米）厚不锈钢表层，4 英寸（100 毫米）宽卷边，白色或黑色的 E-60 mil EPDM 柔性卷材覆盖屋顶（水平表面）或雨棚等。所有的端盖板，过度及斜接应为工厂加工的，以保证水密性。

H. Isolator
隔热垫

For a simple isolator not exposed to weather, PVC is acceptable; for bearing isolator that acts as shim, high impact is preferred; and for isolator with movement requirement (slip pad: friction reducer), high-impact Teflon coated is preferred.
对于一般不暴露在室外的隔离垫片，采用 PVC 材质是允许的；但对于一些受力垫片应采用抗冲击聚合物，而对于一些允许位移的垫片（滑动位移处的减少摩擦力片），应优先使用抗冲击聚四氟乙烯尼龙垫片。

I. Typhoon Proof Louvers
防风雨百叶

1. Louvers shall consist of extruded perimeter frames and blades; frame corners and blade ends shall be fastened with 316 series stainless screws, (min. #12).

   百叶窗应由挤压成型的铝框架及叶片构成，铝框架的角落及铝叶片的末端应以316系列的不锈钢螺钉固定(最小为#12)

2. Provide concealed stiffeners for blades, such that vector sum of blade deflection parallel to principal axes does not exceed L/180 times span at design pressure assuming that pressure acts perpendicular to the plane formed by the corners of the perimeter frame, and that the tributary area for one blade equals its projected area on the same plane.

   各叶片应设置隐蔽式的铝挤型补强背衬，使叶片在平行于其主轴方向上的挠曲量不超过其净跨的 L/180(在设计压力下)，以上系假设压力系

垂直作用于铝框架的 4 个角落所形成的平面，而每一叶片的有效面积为其于上述平面上的投影面积。

3. Continuous louver blades shall be locked and fastened to vertical support members; heads and sills shall have an integral sealant revealed. Provide base catch fan and flashings to shed all water as shown in drawings.

   百叶的叶片须固定于两侧的直料，且上横料及下横料处均须防水密封。根据图面所示提供集水盘及庇水板

4. Provide 316 grade stainless steel bird screen at all active louvers. Mesh shall be 1.6mm minimum thickness and 12.5×12.5 mm openings. Mesh shall be installed in a stainless steel frame.

   所有具有透气功能的百叶窗应加装 316 级不锈钢制品的防鸟网，其厚度最小应为 1.6mm，网目宽度为 12.5x12.5 mm。防鸟网应用不锈钢框固定。

5. Coordinate free area of louvers with mechanical requirement, 50%free area. [Shall be confirmed by Mechanical Engineer]

   百叶窗的透气率须能符合机械要求。透气率最少须为 50 %。(由机电工程师确认)

6. Louvers must be tested in accordance with Dade County protocols TAS-201, TAS-202, TAS-203. Louvers shall be Dade County approved for open structure building envelope protection (including missile), for single unit sizes up to 12 feet wide by 6 1/2 feet high; and for allowable design wind loading up to 130 psf. To maintain Dade County product approval status, the louvers must be attached to a structural substrate in accordance with the Dade County Product Approval Drawings. In addition, the structural substrate to which the louvers are attached must be designed to withstand the point loads transferred by the louvers when subjected to the design wind loads.

   百叶的测试应遵守Dade County protocols TAS-201, TAS-202, TAS-203 规定。百叶应满足Dade County批准的开放结构建筑的围护保护要求，单个单元的宽度至多12英尺，高度6又1/2英尺，允许设计风荷载至多130 psf。为保证Dade County产品质量，百叶须附于结构基片上，具体参考Dade County 产品批准图纸。另外，当应对设计风荷载时，该结构基片须能承受百叶转嫁的点荷载。

7. Finish. (See finishes Article 2.02 Paragraph G)

   表面处理。（详见表面处理2.02.G）

8. Acceptable Products: Colt International Ltd, C/S Louver, Sanki Louver equivalent in accordance with 1.08.I.

   合格产品：Colt International Ltd, C/S 百叶, Sanki 百叶与条款 1.08.I 相一致的同级产品。

9. Performance Requirements:性能要求：

   a. The louver performance shall be established by full-scale wind tunnel tests carried out on a louver measuring not less than 1000mm x

1000mm. Testing and rating shall be performed to H.E.V.A.C. Technical Specification “Laboratory Testing and Rating of Weather Louvers when subjected to Simulated Rain” standard or in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified ratings Program. The AMCA Certified Ratings Seal applies to Wind Driven Rain ratings class A to 4 m/s, Water Penetration Ratings and Air Performance ratings.

百叶的性能必须由实际尺寸的风洞试验决定，试体不可小于1000mm x 1000mm，测试及分级应符合H.E.V.A.技术规范的规定－ ″实验室的百叶于仿真雨测试及分级″(Laboratory Testing and Rating of Weather Louvers when Subjected to Simulated Rain)或参照AMCA Publication 511并符合AMCA 认证的评级程序的要求。AMCA 认证的密封胶评级适用于带强风阵雨评级A级至 4 m/s, 渗水评级 及 空气性能评级。

b. The louver blades shall be aerodynamically shaped to provide minimum restriction to airflow. The louvers shall have a discharge loss coefficient based on free area not less than [50% - Shall be confirmed by Mechanical Engineer].

百叶的叶片需为翼状(Aerodynamically)，使对透气效果产生最低的影响。释放损耗（Discharge Loss）系数不得小于[50%，应与建筑机电工程师确认]

c. The pressure drop across louver under face velocity at ___m/s shall not be greater than ___Pa. [Shall be confirmed by Mechanical Engineer]

压力变化通过叶片时速度为2.5m/s所造成的压力不应大于70Pa. (由机电工程师确认)

d. For wind driven rain: The louver test was based on a 39.370″ (1.00 m) x 39.370″ (1.00 m) core area unit tested at a rainfall rate of 3″ per hour (75 mm/hr) and with a wind directed to the face of the louver at a velocity 29.1-mph (13 m/s) as well as a rainfall rate of 8” per hour (203 mm) and a wind of 50 mph (23.3 m/s). The test data shall show the water penetration effectiveness rating at each corresponding ventilation rate. [Shall be confirmed by Mechanical Engineer prior to manufacturing]

带强风阵雨：百叶测试的百叶面积为39.370″ (1.00 m) x 39.370″ (1.00 m)，在3″per hour (75 mm/hr)仿真雨及29.1-mph (13 m/s) 仿真风，以及在8” per hour (203 mm)仿真雨及50 mph (23.3 m/s)仿真风的作用下，测试数据将得出不同通风率下不同级别的渗水效果。[在制造前需与机电工程师确认]

J. Flashing
挡水板

1. Acceptable materials are stainless steel and silicone sheet at splices/laps. Aluminum flashings are not acceptable. Minimum thickness is 1.0mm for stainless steel and 2.0mm for silicone.

合格的挡水板材料为不锈钢片，对接及搭接处为硅胶片，不可采用铝板。不锈钢片最小厚度为 1.0mm，硅胶片最小厚度为 2.0mm。

2. Provide fully sealed lap/splice joints and end dams as required to direct all moisture to the exterior of the building. Contractor to provide details of all flashing conditions.
在所有的连接处都需打胶密封，并且在其两边设立挡水板，以便将水排除于建筑物体外。承包商应提供所有遮水板详图。

3. Flashing shall occur on the warm side of insulation.
挡水板须设置于隔热材温度较高的一侧。

4. Flashing is not acceptable as a vapor barrier.
挡水板不可作为水气的阻挡板。

5. Gutter assemblies – stainless steel sheet over a “floating” sheet membrane continuously supported. Stainless steel solder joints covered with silicone boots etc.
排水沟：不锈钢上方需覆盖一层连续的薄膜，必须有连续支撑；不锈钢连接焊接处需打硅胶。

6. Flashing joints shall be staggered from joints in the façade by 300 mm minimum.

批水板接缝应相互搭接最小 300mm

K. Window Washing Tie Backs
擦窗机防风插销座

1. Provide window washer tie back assemblies and coordination drawings.

提供擦窗机防风插销座的组装服务，并且结合擦窗机设计要求提供防风插销座相关配合的设计图纸。

2. Semi-concealed flush mounted anchors for tieback restraint of window washing scaffold support cables shall be provided no more than 20 meters of vertical drection and as shown on the BMU drawings and at horizontal intervals determined by the supplier of the scaffold system. Tieback locations shall be approved by the Client.

擦窗机防风插销座为半隐藏式，外端与幕墙齐平。根据BMU设计图纸，垂直方向间距不大于20米提供擦窗机防风插销座，水平间隔需由擦窗机制造商决定。擦窗机防风插销座的位置需经业主代表核准。

3. Tie-back anchors shall be of stainless steel with non-concealed supports, designed and tested for compliance with OSHA STD1-3.3 revised on November 12, 1985.

擦窗机防风插销座的固定螺栓材质为不锈钢且非隐藏式，设计及测试须符合1985年11月12日修正的OSHA STD 1-3.3 标准。

L. Operating Access Windows
开启窗

1. Operable window and door shall meet the more stringent of the requirements of AAMA 101 or these specifications.

   活动窗和门要符合AAMA 101　规范或以较严格的为准

2. Operable window and doors shall be equipped with wind load interlocking clips as required.

   活动窗和门要装配抗风载联动锁扣件

3. Operable window and doors shall be equipped with heavy duty type multi-point locking system as manufactured by "FERCO" or approved equal in accordance with 1.08.I.

   活动窗和门要装配由FERCO生产的重载多点制动系统或1.08.I中经核审的等同产品。

4. Operable sash shall be weather-stripped with two (2) rows of continuous neoprene gasket with vulcanized corners.

   活动窗的四周须配置以二条连续的氯丁橡胶胶条

5. Operable handle for multi-point locking system: operable door shall also be equipped with one handle for opening and closing the operable sash.

   为多点制动系统安装活动手柄。活动门也应安装活动手柄。

6. Operable sash shall be equipped with limit stops. (150mm maximum opening) The limit stops shall be fully opened for emergency without using any equipment.

   安装限制器以维持150mm的最大开口。在紧急情况下，限制器应能在不使用任何工具的情况下完全打开

M. Operating Sash.
开启窗框

1. Requirements as mentioned above.
   上面提到的要求

2. Operable sash shall be equipped with automatic concealed hardware.
   开启窗框应与自动隐藏的五金件配套。

N. Entrance doors.
入口大门

1. Entrance door shall meet the more stringent of the requirements of AAMA 101, AAMA SFM-1-87 of these specifications.
   入口大门需满足 AAMA 101, AAMA SFM-1-87 中较严格的标准。

2. Provide entrance doors including hardware as shown on drawings and schedules. Refer to door and hardware specifications.
   如建筑图及进度表所示，提供入口大门，包括五金。参考门及五金规格说明。

   a. Revolving door shall be ‘Crystal Tourniket’ by Boon Edam. Refer to Architect’s specification.

      旋转门应为宝顿的“Crystal Tourniket”，参见建筑师技术说明。

b. Vestibule frameless glass doors shall be provided with Dorma ED400IG offset in-ground pivot and Dorma Universal patch fittings – PT 20 top patch and PT 10 bottom patch made of Brass and have a satin chrome plated (500) finish. See Attachment E.

前厅无框玻璃门应采用 Dorma 的 ED400IG 门，采用嵌入地面的门轴及 Dorma 常规铰链——顶部 PT 20，底部 PT 10，由黄铜制成，电镀砂铬（500）表面处理。参考附件 E。

3. Provide tempered glass as per Articles 1.07 and 2.04 for entrance doors. Curtain wall Contractor to verify minimum required glass thickness for wind load, crowd load.
为入口大门提供符合本规范条款 1.07 及 2.04 要求的全钢化玻璃。外幕墙承包商须核实玻璃的最小厚度以符合风力及人群推挤荷载要求。

O. Hardware
五金

Provide all prepping, coordination and installation for hardware to be provided by others for specified doors specified per door and hardware specifications or as specified on AAMA SFM-1-87 Section 3.
需和提供五金的相关单位协调配合，预安装和安装相关五金件，而特定的门及其特定五金件必须符合有关规格技术说明规定的要求或根据 AAMA SFM-1-87 第 3 章节规定。

P. Thermal Breaks
防热传导的断热条

1. Thermal breaks that are integral to extruded aluminum frames shall be continuous polyamide nylon or continuous polyurethane. Increase separation as required to comply with specified thermal performance.
防热传导的断热条必须与铝型材完全贴合，材质为聚酰胺尼龙或聚亚安酯尼龙，增加间隔须符合隔热性能的要求。

a. Polyamide continuous extruded high performance nylon with multi-directional 25% glass fiber reinforcing as manufactured by Technoform (Technoform Bautec Strut) or approved equeal. All polyamide material must be from a minimum of 90% virgin components with a maximum 10% pre-consumer regrind. Aluminum components shall be mechanically crimped into cross knurled cavities and obtain a minimum composite shear value of 800 pounds for a 100mm section.

由泰诺风（泰诺风保泰）或其他许可的同等档次品牌生产的高性能尼龙与 25%异向玻璃纤维混合挤压成型的聚酰胺材料隔热条。所有的聚酰胺材料必须至少使用 90%的原生尼龙，最多使用 10%的回收材料。铝型材构件需将其卷压至凸边构成的空腔内，并使得 100mm 的组合截面能承载最少 800 磅的剪力。

b. Polyurethane shall be poured into a cavity of a single extrusion. The extrusion shall be debridged after the polyurethane hardens. The cavity shall have closely spaced indentions to mechanically lock the polyurethane against slippage in the cavity.

聚亚安酯尼龙必须浇注至铝型材槽内，待聚亚安酯尼龙半钢化后再将另一侧的铝料切除，铝型材槽必须将聚亚安酯尼龙完全咬合，防止聚亚安酯尼龙滑动。

2. Thermal breaks that are clamped between two layers of metal with fasteners shall be rigid PVC or one of the materials specified for glazing gaskets in this Section.
金属以螺丝固定时，必须于中间放置应质 PVC 防热传导的隔片，或本规范规定的胶条。

3. Thermal breaks shall not split, crack or fracture. Thermal breaks shall not experience shrinkage or other deformation to the extent that frames are distorted or water leakage occurs. Extruded aluminum frames with integral thermal breaks shall conform to specified tolerances for one-piece aluminum extrusions.
防热传导的断热条不可分离、破裂或断裂，且于铝型材内不可收缩或变形。防热传导的隔片与铝型材整合的误差须与单一型材相符。

Q. Cast-in Embedment
预埋件

1. Steel Plate Embedment
板式埋件

Steel Plate should be made by Carbon Steel. The performance should not less than Q235 steel as per GB code. The steel rebar should have full penetration weld, the finish should be hot dip galvanized and should not less than 85 um.

钢板应为碳钢材质，性能不能低于国标 Q235 钢材。锚筋应采用熔透焊接到钢板上。表面处理应进行热浸镀锌处理，镀层厚度不应低于 85um。

2. Channel Embedment
槽式埋件

The Channel Embedment should have a same design and service life time of the main building structure and not less than 50 years, it should have the relevant certification.

槽式预埋件的设计使用年限应与幕墙建筑的主体结构相一致，宜不低于 50 年，并通过相关认证。

a. Channel embedment should be made of carbon steel, whose every performance index is no less than Q235 steel and it must be hot dip galvanized surface treatment, coating thickness should not be less than 50 μm.
槽式预埋件应采用碳钢材质，所用材料各项性能指标不低于 Q235 号碳钢，表面应进行分件热浸镀锌处理，镀层厚度不宜小于 50um。

b. The steel material of assorted T-bolts should be: carbon steel (4.6 grade or higher); hot dip galvanized coating (no less than 45μm). The Tension and shear design value of each T-botlt and each insert

rebar should not greater than the capacity of the T-Bolt and insert.
配套 T 型螺栓钢材材质应为：4.6 级以上（包括 4.6 级）碳钢，表面应进行热浸镀锌处理，镀层厚度不宜小于 45um。单个 T 型螺栓和单根锚筋的受拉及受剪设计值不应超过其抗拉抗剪承载力设计值。

c. To avoid grouting mortar enters, chamber of channels should be compactly full of filler. The filler may use LDPE material.
为避免漏浆，槽体内应密实填充密封条。密封条宜采用聚乙烯（LDPE）材料。

d. The connection between Channel profile and Anchor should adopt the cold-joint and non-welding design, in order to ensure no welding residual stress, and to avoid zinc coating problem caused by acid residues after the acid pickling.
槽式预埋件的槽身与腿部宜采用冷连接设计，确保预埋槽腿部无焊接残留应力，并且避免酸洗时酸液残留在焊接缝内导致破坏镀锌层的问题。

e. Channel embedment's design report should contain the analysis of failure mode of steel/ concrete under tension or shear loads, verifications for governing failure mode and its utilization under combined tension and shear loads.
槽式预埋件的计算书中应分别包含受拉力荷载及剪力荷载的钢材破坏/混凝土破坏模式分析，并且具体提出对该节点的最不利破坏模式及其利用率，最后进行拉剪复核。

f. The Channel embedment manufacturer should offer repair measures based on experimental results in case of a bad installation.
槽式预埋件厂商必须提供有实验依据的预埋槽安装偏位后的修补措施。

g. The minimum insert length of Channel Embedment shoud not less than 90mm. the distance between the insert should not less than 100mm, the maximum distance should not great than 250mm.
槽式预埋件的锚筋有效锚固深度不得低于 90mm。两个锚筋间的最小距离不得小于 100mm，最大间距不得大于 250mm。

h. The distance betweent the channel embedment to the edge of the concrete should not less than 50mm. if it located inside the protection layer of the concrete, it should have reinforcement to avoid the edge of concrete break and danmaged.
槽式预埋件与混凝土构件的最小边距不应小于 50mm。如位于构件混凝土保护层厚度内，应有构造加固措施，防止混凝土边缘出现劈裂和剪撬破坏。

i. The capcity of the channel embedment for the dynamic performance and when expose the fire should be tested and certificated. For the building located at seismic zone, the connection should use Channel embedment and T-bold with thread.

槽式预埋件的动载性能和遇火时的承载力设计，应通过相关的认证测试。对于抗震设防要求较高的幕墙建筑，宜采用带锯齿的槽件和 T 型螺栓。

R. Post-Install Bolt
后置锚栓

When the Post-Install Bolt is used, it should be ensure the connection secure and safe according to the loading condition and have a right setting out, it should satisfy with the following:

1. The bolt for Post-install embedment should be self-expand-bottom bolt, Mold-expand-bottom bolt, special cone bolt or chemical bolt. The tension performance of steel for the bolt should be tested, the result should comply with the requirement of the Design Code for strengthening concrete structure (GB50367).
后置埋件用锚栓应选用自扩底锚栓、模扩底锚栓、特殊锥形锚栓或化学锚栓。锚栓钢材受拉性能须进行复验，复验结果应符合《混凝土结构加固设计规范》GB50367 的规定。

2. The exposed part of the bolt should have anti-corrosion treatment.
锚栓外露部分应防腐蚀处理。

3. The diameter and number of bolt should be determained by calculation. The diameter should not less than 10mm, each embedment should not have less than 2 bolts.
锚栓直径和数量应计算确定。锚栓直径不小于 10mm，每个后置埋件上不得少于 2 个锚栓。

4. The design capacity of the bolt should not greater than 50% of it ultmated capacity, it should be tested on site and have the ultimate pull out test if necessary.
锚栓承载力设计值应不大于其极限承载力的 50%，并进行承载力现场试验，必要时进行极限拉拔试验。

5. If there is welding work happen on the post-install embedment after it set on position, the bolt should be Mechincal expand-bottom bolt, or use chemical bolt together with mechincal bolt. If the number of chemical bolts more than half of the total number of the post installed bolt, there should not have any welding work happened on the embedment after it set on the position.
就位后需焊接作业的后置埋件应使用机械扩底锚栓，或化学锚栓与机械锚栓交叉布置。化学锚栓超过半数的后置埋件，就位后不得再其部件及连接件上焊接工作。

6. The Bolt material should be SS316。
锚栓材质须为 316 不锈钢。

S. Back bolt for Stone
石材用背栓

1. The insert depth of the back-Bolt should be 2/3 of the panel thickness and not less than 15mm. the distance between the hole of the back-bolt to the

edge of the stone should not less than 5 times of the stone thickness and not greater than 0.2 of the supported length. The remining thickness from the bottom of the hole to the surface of stone should not less than 8mm.
背栓孔切入的有效深度宜为面板厚度的 2/3， 且不小于 15mm。背栓孔离石材边缘净距离不宜小于板厚的 5 倍，且不宜大于其支撑边长的 0.2 倍。孔底至面板的剩余厚度应不小于 8mm。

2. The hole should seal with epoxy when install the back-bolt.
背栓螺栓埋装时，背栓孔内应注环氧胶粘剂。

3. The back-bolt should be SS316 material. The diameter of bolt should not less than 6mm and each support bracket should have two bolts.
背栓应采用不锈钢 316 材质。直径不应小于 6mm，每个托板宜用 2 个连接螺栓。

4. The back-bolt support should have adjustment and anti-lifting device.
背栓支撑应有防松脱构造并有可调节余量。

2.04 GLASS 玻璃

A. General Requirements
一般要求

1. Glass shall be of the type and minimum thickness, as indicated in the drawings and specifications and shall meet the performance requirements of Articles 1.07.paragraph J.
建筑图及规范指明的玻璃种类及厚度，须符合本规范条款1.07.J性能要求的规定。
2. The responsibility for design and engineering shall be the External Facade Contractor's. Notwithstanding the types and minimum thickness specified in Article 1.07 paragraph J and shown in the drawings, provide thickness and types required to meet specified performance requirements.
外幕墙承包商须负责设计及计算。虽然本规范条款1.07.J及建筑图已指明玻璃的种类及厚度，但外幕墙承包商仍须确认玻璃种类及厚度，符合规范性能要求的规定
3. Provide heat-strengthened glass required by design to withstand wind pressures, anticipated thermal stress, or use in a spandrel area.
在有热应力或使用在窗间墙区域，提供满足风荷载设计的半钢化玻璃。
4. Provide fully tempered glass only where safety glass is mandatory, where design pressures are beyond the capacity of heat-strengthened glass or as required by the code only.
在需要使用安全玻璃，设计风压超过半钢化玻璃的强度容许值或当地规范要求。
5. The façade contractor must replace the glass if there is stress mark or rainbow mark which can be seen.
只要肉眼见到的应力斑、彩红斑，不论面积多大，幕墙中标单位必须无条件更换”
6. Finishes 表面颜色:

Finish and color to be specified by Architect, see the material list provided by Architect and match with the control smaple provided by architect.

表面处理及颜色由建筑师确定，详见建筑师提供的材料清单并且应与建筑师提供的控制样板一致。

B. Provide safety glass in conformance with CPSC 16 CFR 1201 and local code.
提供满足CPSC16 CFR1201或当地规范要求的安全玻璃。

C. Float Glass
浮法玻璃

1. Annealed float glass shall conform to GSA Specification DD-G-45ld, ASTM C 1036 and GB 11614.
退火浮法玻璃须符合 GSA DD-G451d，ASTM C 1036，GB 11614 等规范。

2. Clear float glass shall conform to ASTM C 1036, Type 1, Class 1, Quality q^3 except as modified herein.
除特别说明外，透明浮法玻璃(Clear float glass)须符合 ASTM C 1036,Type 1, Class 1, Quality q^3 的标准。

3. Tinted, heat absorbing float glass shall conform to ASTM C 1036, Type 1, Class 2, and Quality q^3 except as modified herein.
除特别说明外，彩色玻璃(Tinted glass)及吸热玻璃(Heat absorbing glass)须符合 ASTM C 1036,Type 1, Class 2, Quality q^3 的标准。

4. Edge quality criteria for annealed float glass are as follows:
一般玻璃(Annealed Glass)的边缘品质要求如下：

a. Shark teeth shall not penetrate more than half of glass thickness.
锐裂沟(Shark Teeth)的深度不得超出玻璃厚度的一半。

b. Serration hackle may occur only within 150 mm of corners.
锯状细裂沟(Serration Hackle)仅在角落且长度不许超过 150mm 。

c. Flare shall not exceed 0.8 mm as measured perpendicular to glass surface across the edge. Flare shall not occur at setting blocks.
玻璃板片边缘的突出部份(Flare)不得超过 0.8mm，此突出部份的测量应垂直并横跨于边缘表面。突出部份不得发生在玻璃的支承橡胶块。

d. Bevel shall not exceed 1.6 mm.
玻璃板片边缘的倒角不得超过 1.6mm。

e. Flake chips may occur only within 200 mm of corners; depth shall not exceed 0.8 mm and length or diameter shall not exceed 6.4mm (0.25").
玻璃边缘的鳞片状凹痕(Flake Chips)只允许发生在距玻璃转角 200mm 以内。鳞片状凹痕的深度不许超过 0.8mm，且直径或长度不许超过 6.4mm (0.25")

f. Rough chips are not permitted. Rough chips are those, which exceed

any of the dimensional limits for flake chips.
粗糙凹痕(Rough Chips)不许发生。凡凹痕深度及长度超出鳞片状凹痕的限制值，时便称为粗糙凹痕。

D. Heat Strengthened and Fully Tempered Flat Glass
半钢化(Heat-Strengthened)及钢化平板玻璃(Fully Tempered Flat Glass)

1. Glass for heat strengthening and fully tempering shall conform to Article 2.04.C, Float Glass.
使用于半钢化(Heat-Strengthened)及全钢化(Fully Tempered)玻璃，须符合本规范条款 2.04.C 浮法玻璃(Float Glass)规定。

2. Heat strengthened and fully tempered flat glass shall conform to GSA Specification DD-G-1403c, ASTM C 1048, GB 15763.2 and JG/T 455 except as modified herein.
除特别说明外，半钢化及全钢化平板玻璃须符合 GSA DD-G-1403C，ASTM C 1048，GB 15763.2，JG/T 455 等规范要求

3. Heat strengthened glass shall conform to ASTM C 10482, kind HS.
半钢化玻璃(Heat-Strengthened Glass)须符合 ASTM C 1048, Kind HS 的标准。

4. Fully tempered glass shall conform to ASTM C 1048, kind FT and ANSI Z97.1.
全钢化玻璃(Fully Tempered Glass)须符合 ASTM C 1048, Kind FT 及 NSI Z97.1 的标准。

5. Heat strengthened and fully tempered glass shall be examined by the glass manufacturer to detect and discard any lights which exceed the following tolerances:
玻璃制造商应检查半钢化及全钢化玻璃并剔除超过下述容许误差的玻璃：

   a. Overall bow shall not exceed: 1.6 mm in 610 mm; 3.2 mm in 1525 mm; 6.4 mm in 3050 mm; 9.5 mm in 4575 mm.
   总弯曲量(Overall bow)不得超过：610mm 内为 1.6mm；1525mm 内为 3.2mm；3050mm 内为 6.4mm；4575mm 内为 9.5mm。

   b. Roller wave distortion: Where the strengthening process results in essentially parallel ripples or waves, the deviation from peak to valley shall not exceed 0.076 mm and the difference between adjacent peaks shall not exceed 0.040mm.
   波浪状变形(Roller Wave)不得超过：玻璃经热处理后所造成的波浪状变形，其峰顶至峰谷的距离不得超过 0.076mm；相邻峰顶的距离不得超过 0.040mm。

   c. Where bow tolerance and roller wave distortion tolerance differ, the stricter requirement shall govern.
   当曲度及波浪状变形(Roller Wave)的变形量不一致时，应采用较严格的标准。

   d. For glass that has been heat-treated horizontally, maintain roller marks running horizontally in the as-built condition. For glass that

has been heat treated vertically, locate tong marks along edges that will be concealed in the glazing system in the as-built condition. Direction of ripples shall be consistent on the project and in conformance with the Architect's visual criteria in addition to specification.
玻璃热处理为水平方式时，工地安装时，波浪状变形(Roller Wave)的方向应一致。玻璃热处理为垂直方式时，工地安装时，须将夹痕隐藏。波纹的方向应一致，且须符建筑师及本规范要求的规定。

e. Anisotropy or Stain Pattern: Glass to be evaluated on "fit for purpose" bases.

各向异性或污迹斑纹：玻璃应根据下列规则评估。
The acceptable level of anisotropy shall be established at the approval of full size glass sample and visual mock-ups. Approval glass to be considered as control sample for all glass on the building.

各向异性的可接受等级将根据全尺寸样品和视觉样板来确定。审核通过的玻璃将作为整个项目所有玻璃的控制样板。

Glass shall be assessed for anisotropy level by the following visual inspection:

玻璃应根据下列视觉检查来评估各向异性等级：

- View glass panel from 3m distance, in standing up position

  从玻璃 3 米远的地方，竖直观看。

- Viewing angle: 0 degrees to 45 degrees maximum between the perpendicular to the surface of glass and the position of the observer.

  观察角度：由垂直于玻璃到观察人站立的间角度从 0 度到 45 度。

6. Provide glass manufacturer's certification of heat soak testing of 100% of the fully tempered glass for this project (excluding the tempered Low-Iron Glass).
须提供玻璃制造商出具的证明，证明本工程所使用的全钢化玻璃完全经过热浸透试验（超白钢化玻璃除外）

E. Laminated Glass
夹胶玻璃

1. Glass used for fabricating laminated glass shall meet fully requirements of Articles 2.04.C, Float Glass and 2.04. D, Heat Strengthened and Fully Tempered Flat Glass.
使用于胶合加工的玻璃，须符合本规范条款 2.04.C 浮法玻璃(Float Glass)及 2.04.D 半钢化(Heat-Strengthened)及全钢化平板玻璃(Fully Tempered Flat Glass)的规定。

2. Laminated glass shall conform to ASTM C1172 and ANSI Z97.1 except as modified herein.

除特别说明外，夹胶玻璃须符合 ASTM C 1172，ANSI Z97.1，GB 15763.3 等规范要求。

3. Laminated Glass shall consist of two layers of glass with similar thickness, and a clear plasticized polyvinyl butyryl (PVB) interlayer of not less than 1.52 mm nominal thickness. The PVB interlayer shall be the product of virgin resin, the product of recycled resin would be rejected. The PVB should be one 1.52mm thick product. Do not accept using thinner product add together as 1.52mm.

   夹胶玻璃由两片厚度相近的玻璃及高透的聚乙烯醇缩丁醛夹胶膜(PVB)组成，膜厚不得小于 1.52mm。该 PVB 夹胶膜应为原生料制品，不接受回收料制品。PVB 胶片应为单片 1.52mm 厚的产品，不接受使用薄片累计厚度。

4. For exposed edges use other laminants such as Sentry Glass Plus (SGP) which is “Dupont” product or approve equal or similar product that will also satisfy the requirement to avoid de-lamintation.

   外露玻璃翼应使用 Dupont 的 Sentry Glass Plus（SGP）膜或其他审核通过的同等产品或满足避免开胶要求的产品。

5. Prior to laminating, cut glass to required sizes and shapes, making allowance for edge clearances. Trim interlayer prior to treatment in autoclave oven as required to avoid further trimming after treatment. Laminated glass interlayer shall have autoclaved edges.
   于玻璃胶合前，将玻璃切割成所需尺寸及形状，胶合膜的尺寸亦需切割成所需尺寸及形状，避免胶合完成后再进行切割。夹胶玻璃胶合膜必须为 Autoclave Edge。组成的玻璃其边缘须平整。

6. Fully tempered glass is acceptable for laminated glass only if the design requirements exceed the strength of heat-strengthened glass.
   若设计风压的要求值超过半钢化玻璃的强度时，则可采用全钢化玻璃胶合。

7. Provide independent testing to be submitted to show compliance to project specifications standards such as ASTM C1172 & ANSI Z97.1. Testing shall be based on project production materials by project laminator. No historical testing will be allowed.

   根据 ASTM C1172 或 ANSI Z97.1 等相关规范要求独立进行试验。试验应该采用本项目实际选用材料。不允许参照已经做过的试验。

8. Provide certification documents as per Article 2.04 I.

   按照 2.04I 条款提供证明文件。

F. Coated Glass
   镀膜玻璃

1. Glass used for manufacturing coated glass shall meet fully requirements of Articles 2.04. C, Float Glass and 2.04. D, Heat Strengthened and Fully Tempered Flat Glass.

使用于镀膜的玻璃，须符合本规范 2.04.C 浮法玻璃(Float Glass)及 2.04.D 半钢化(Heat-Strengthened)及全钢化平板玻璃(Fully Tempered Flat Glass)的规定。

2. Coated glass shall conform to ASTM C 1376, GB/T 18915.1, GB/T 18915.2 except as modified herein.
除特别说明外，镀膜玻璃须符合 ASTM C 1376，GB/T 18915.1，GB/T 18915.2 等规范要求

3. Glass reflective coatings shall conform to the following criteria:
玻璃的反射镀膜须符合下列准则：

   a. Inspection shall be made at a distance of 3.05 meters from the glass, viewing perpendicular to the glass plane, with any natural lighting for which flaws are clearly visible.
   检查员的位置应于距玻璃 3.05m 处，由垂直玻璃平面的方向检视，检视时利用自然光线，其亮度须足以显示反射膜的瑕疵。

   b. The central area is a square or rectangle concentric with the daylight opening and having width and height respectively equal to 80 percent of the daylight opening width and height.
   玻璃板片的中心区域是指一与玻璃透光部分同心的正方型或长方型区域。而此一区域的宽与高分别是玻璃透光部分宽与高的 80%。

   c. The perimeter area extends from the border of the central area to the edges of the daylight opening.
   玻璃片的边缘区域是指上述中心区域的四边以外到玻璃透光部分四周的区域。

   d. Pinhole diameter shall not exceed 1.0 mm.
   针孔的直径不得大于 1.0mm。

   e. Within any 300 mm diameter circle, there shall be no more than one pinhole with diameter of 1.0 mm max.
   直径 300mm 的圆形区域内，不许发现任何直径超过 1.0mm 的针孔。

   f. There shall be no more than 4 pinholes of 1mm diameter or less within the central area. There shall be no more than 3 pinholes in the perimeter area (in addition to the allowable in the central area).
   中心区域不可发现，超过 4 个直径超过 1mm 针孔；边缘区域的针孔不可超过 3 个（除中心区域的允许范围外）。

   g. Scratches shall not exceed 50 mm in length or 1mm in width.
   刮痕的长度不得大于 50mm，或宽度大于 1mm。

   h. There shall be no more than 4 scratches of max. 50 mm in length or max. 1mm in width within the central area. There shall be no more than 3 such scratches in the perimeter area (in addition to the allowable in the central area).

中心区域不可发现，超过 4 条最大长度为 50mm，或最大宽度为 1mm 的刮痕；边缘区域的刮痕不可超过 3 条（除中心区域的允许范围外）。

i. Streaks or splotches resulting from non-uniformity of the coating, which are visible from the building interior or exterior, are not permitted.
反射膜上不准有从室内或室外皆看得出来不均匀的条纹或斑点。

j. Streaks cause by post tempering is not permitted; provide full scale visual mockup for Architects evaluation prior to production.
条纹回火邮寄费用是不允许的，在生产之前提供全面的视觉模拟 – 供建筑师审核。

k. Color range must fall within the limits established by samples approved by the Architect.
反射膜的颜色，必须介于建筑师所核准样品的颜色范围的内。

l. Coating shall not affect adhesion and strength of structural and other sealant.

涂膜不应该影响结构胶或其它密封胶的粘结性和强度。

G. Insulating Glass
中空玻璃

1. Glass used for fabricating insulating glass units shall meet fully the requirements of Articles 2.04. Paragraph C, Float Glass and 2.04. Paragraph D, Heat Strengthened and Fully Tempered Flat Glass.
使用于中空玻璃加工的玻璃，须符合本规范条款2.04.C浮法玻璃(Float Glass) 及 2.04.D 半钢化 (Heat-Strengthened) 及全钢化平板玻璃 (Fully Tempered Flat Glass)的规定

2. Insulated glass shall be IGCC certified and rated and shall conform to ASTM E773 and GB/T 11944 except as modified herein.

除本规范特别说明，中空玻璃应按 IGCC 标准进行认证和评估，且需符合 ASTM E 773 及 GB/T 11944 等规范要求。中空玻璃应采两道边缘密封。

3. Insulating low-E glass shall be produced with visible indication of Low-E coating.
中空Low-E玻璃应明确标识出Low-E镀膜所在面。

4. Insulating glass shall be sealed hermetically with dual edge seals.
中空玻璃应在周边进行双层密封。

5. Primary seal shall be SikaGlaze IG-5PIB, HB Fuller PIB 969, Kommerling GD 115. Minimum width of primary seal shall be 3.2mm.Edge deletion of coating shall be done or as required by insulating glass fabricator.
初级密封应为SikaGlaze IG-5PIB, HB Fuller PIB 969, Kommerling GD 115。其最小宽度应为3.2mm, 应进行包覆边的角切除，或者遵循中空玻璃加工商的意见。

6. Secondary seal shall be Dow Corning 939, Dow Corning 3362N, Sikasil IG25 or Sikasil IG25 HM Plus for Argon filled.Secondary seal shall completely cover spacer with no gaps or voids, and shall be continuously

bonded to both plates of glass. Insulated glass shall be IGCC certified and rated and shall conform to ASTM E 773.
第二道密封使用Dow Corning 939, Dow Corning 3362N, Sikasil IG25 or Sikasil IG25 HM Plus for Argon filled.。第二道密封应完全覆盖金属背衬，没有缝隙或气泡，两面玻璃应同时与金属背衬接合。中空玻璃应为IGCC认证及排名的，并且遵守ASTM E 773。

7. Where glass coatings are susceptible to deterioration due to contact with moisture, the coating shall be edge deleted prior to fabrication of the insulated glass unit. The edge deletion shall be complete, including corners, with all edges of coating terminating within the zone of the primary sealant for protection against moisture migration and contamination. The glass manufacturer shall specify in writing which coating requires edge deletion prior to submittal of samples. Acceptable aesthetic quality of edge deletion shall be established on the basis of approved glass samples.
当玻璃镀膜会因水气而造成损坏时，于玻璃组装前，需将玻璃边缘部分的镀膜去除，去除范围从边缘至第一道密封，以防止水气破坏镀膜。玻璃制造商于样品送审前，须以书面说明那一片玻璃镀膜需去除。外观将以核准的样品为标准。
8. Aluminum spacer shall be desiccant filled, including corners. Aluminum spacer shall be custom painted as determined by Architect.
铝间隔条应填塞干燥剂，包含转角处。铝间隔条颜色需由业主代表决定
9. Provide insulating glass units with breather devices to compensate for atmospheric pressure differential between site of fabrication and final installation.
中空玻璃需提供平衡压力的呼吸装置，补偿加工地区与工地的压力差
10. Ceramic coating shall conform to ASTM C 1048.
彩釉应符合ASTM C 1048.

H. Glazing material
镶嵌材料

1. Gaskets and weather-strips except at structural silicone glazing
玻璃压条(Gasket)和耐候压条(Weather-strips)，结构硅胶处除外：

a. Sponge gaskets shall be silicone extrusions conforming to ASTMC 509. Color shall be as selected by the Client Representative. Hardness shall be 40 +/- 5 Shore A durometer. Design sponge gaskets to provide 20% to 35% compression.
海绵质垫片(Sponge Gaskets)应为挤压成型的硅胶，颜色由业主代表选择决定，并符合 ASTM C 509 的规定。硬度为 40 +/- 5 (Shore A 硬度计) 。海棉垫片的设计应能提供 20％至 35％的压缩。

b. Dense gaskets shall be black neoprene extrusions or silicone conforming to ASTM C 864. Hardness shall be 75 +/- 5 Shore A durometer for hollow profiles and 60 +/- 5 Shore A durometer for solid profiles.
高密度压条(Dense Gaskets)应为黑色挤压成型品或硅胶，并符合 ASTM C 864 的规定。空心者的硬度为 75 +/- 5 (Shore A 硬度计) ，实心者为 60 +/- 5 (Shore A 硬度计)) 。

c. All corners of gaskets to be vulcanized.
所有压条的转角须作硬化处理。

d. Interior and exterior gasket profiles shall be designed to produce a glass edge pressure of not less than 0.70N/mm, not more than 1.75N/mm.
内部及外部压条的设计应能提供最少 0.7N/mm，最多 1.75N/mm 的压力于玻璃边缘。

2. Gaskets at structural silicone glazing.
结构性填缝材料处的压条

a. Glazing gaskets, sealant backers within glazing pockets and continuous glass spacer pads at structural silicone shall be heat cured silicone rubber (type one where sealant adhesion is to be prevented and type two where adhesion is desired). Color shall be as selected by the Client Representative.
镶嵌所用的压条，槽沟内密封胶所用的泡绵及结构性填缝材料处所用的玻璃背衬(Glass Spacer)等皆应为热处理硅胶(Heat cured Silicone rubber)(如欲避免黏合，应使用第Ⅰ型；如欲黏合，则应使用第Ⅱ型)。颜色由业主代表决定。

b. Properties falling within the range listed below are acceptable provided that adequate glass support and weather seals are achieved.
若材料的特性位于下列范围内时，则皆可使用为玻璃支撑及填缝材的背衬。

Durometer +/- 5, Shore A Reading	50	60	70
Tensile, psi Min.	800	800	900
Elongation, % Min.	300	200	200
Tear, Die B psi Min.	65	70	80
Compression Set, % Max.			
22 Hrs. at 100 °C	20	20	25
22 Hrs. at 175 °C	40	40	50
Heat Age for 70 Hrs. at 100 °C			
Durometer A, Change Pts. Max.	+ 3	+ 3	+ 3
Tensile, Change % Max.	-10	-10	-10
Elongation, Change Max. %	-20	-20	-20

3. Gaskets, which maintain glass face clearance while serving as a backer for a silicone weather seal may have a friction fit. All other gaskets and weather strips, including backers for structural silicone, shall have a continuous spine or a continuous groove, which engages a matching groove or leg on the aluminum frame.
如采用维持玻璃间隙的压条作为填缝材料的背衬时，可藉其磨擦而嵌合，所有其它的压条及抗候压条，包括结构性填缝材料的背衬在内，皆需设有一连续凹槽或凸起，以与铝料上的凸起或凹槽相楔合

4. Norton V2100 Thermalbond Tape is acceptable as a glass spacer pad when used in conjunction with structural silicone, subject to written verification of compatibility and acceptance by glass manufacturer.

Norton V2100 Thermalbond 胶带可作为玻璃间隙的背衬，与结构性填缝材料并用，但需获得玻璃制造商的说明证明确认其兼容性及合格性。

5. Setting blocks.
玻璃垫块

a. Setting blocks shall be dense extruded neoprene or silicone with a hardness of 85 +/- 5 durometer Shore A, a minimum length of 100 mm, and a minimum width corresponding to the glass thickness. Setting blocks shall be located at quarter points below glass or at a spacing approved by the glass manufacturer. Under no circumstance shall the setting blocks be located closer to the edges than eight points or 150mm (6") whichever is greater.
玻璃垫块应为密质挤压成型的氯丁橡胶(Neoprene)或硅胶(Silicone)；硬度为 85±5(Shore A 硬度计)，最小长度为 100mm，最小宽度则相当于玻璃厚度。玻璃垫块应定位于玻璃跨度的 1/4 位置处，或玻璃制造商核准的位置。玻璃垫块离边缘的位置不得小于玻璃宽度的 1/8 或 150mm(6")处，以较大处为准。

b. Shims used in conjunction with setting blocks shall be of the same material, hardness, length and width as the setting blocks.
与玻璃垫块并用的垫片，必须具有相同的材质、硬度、长度及宽度。

c. Setting blocks and chairs shall be secured against migration.
玻璃垫块及其基座应妥为固定，以防止移动。

d. Silicone setting blocks are required where structural silicone occurs at the sill.
若玻璃底槽采用结构性填缝材料时，亦应使用硅质(Silicone)玻璃垫块。

6. Side blocks.
侧块

a. Locate side blocks within the upper half of each jamb for each lite. Blocks shall be 55 +/- 5 durometer Shore A dense neoprene or silicone. Install block with 3.2mm clearance between block and bearing surface. Block shall be of sufficient length to prevent point loading on the glass.
侧块应定位于各窗边框的上半部，侧块应为硬度 55 +/- 5 (Shore A 硬度计) 的氯丁橡胶(Neoprene)或硅胶(Silicone)，安装时侧块与邻接表面应 3.2mm 的间隙，其长度亦应足够，以免对玻璃造成单点负载。

b. Side blocks are not required where an individual glass light is continuously sealed with silicone at two or more edges.
当玻璃窗的二边或多边已使用硅胶(Silicone)连续密封时，无需使用侧块。

I. Glass Manufacturer Certification
玻璃制造商证明文件

1. Provide certification on authenticity and source of glass material according to specification or approved equivalent.
提供根据技术说明提供玻璃原材料或同级产品的真实性证明。

2. Provide certification from the glass manufacturer that the glass manufacturer has reviewed all glass and glazing conditions and details applicable to the project, and finds same suitable for use with proposed glass. The glass manufacturer shall confirm applicability of their warranty based on the reviewed glass and glazing details.
承包商须呈送一份正式证明书，保证以对所有的玻璃及其玻璃安装方式和详图作了审核，并且都可满足此项工程的安装及使用需求。玻璃制造商须根据审核过的玻璃及安装详图确认证明书其玻璃质保的适用情况

3. Provide an ASTM E 1300 (latest edition) wind analyses endorsed by the glass manufacturer and the External Facade Contractor demonstrating that the maximum probabilities of breakage do not exceed 8 lites/1000 for each type, size and thickness of exterior glass on the project.
提供玻璃制造签署的ASTM E 1300玻璃分析。外幕墙承包商须证明本工程室外每一种类、尺寸及厚度的玻璃，其破裂比例每1000片不超过8片。

4. Thermal Stress Analysis and Statement
温差应力分析及声明
   a. Provide a thermal stress analyses for each type, size and thickness of exterior glass on the project. Calculations shall consider both partial and full shading conditions under the expected service temperature conditions.
   针对本工程室外每一种类、尺寸及厚度的玻璃，提供温差应力分析，计算需考虑玻璃的部分阴影及全部阴影
   b. Provide a statement from the glass manufacturer confirming there is no possibility of thermal breakage of the glass based on the project glass and glazing conditions.
   提供声明书，说明使用于玻璃帷幕墙的玻璃，不会因热应力及温差应力导致玻璃破裂

2.05 SEALANT MATERIALS 密封胶材料

A. Products.
产品
   1. Specified products are acceptable subject to testing and certification based on Article 2.05.paragraph F.
   特定材料的被接受需基于试验结果和证书，符合本规范2.05.F的规定
   2. Non-Structural Seals shall confirm to ASTM C 920 and GB/T 14683.
   一般非结构性耐候密封胶应符合ASTM C 920及GB/T 14683 等规范要求。
      a. Acceptable products (subject to tests): Dow Corning 791, Sikasil WS-305CN.
      可接受的产品（根据检测）：Dow Corning 791, Sikasil WS-305CN。

3. Structural Seals shall confirm to ASTM C 1184 and GB 16776.
结构胶应符合ASTM C 1184及GB 16776 等规范要求
   a. Acceptable products (subject to tests): Dow Corning 995, Dow Corning 993N, MPM SSG 4000, Sikasil SG-18, Sikasil SG-20 and Sikasil SG 500CN.
   可接受的产品（根据检测）：Dow Corning 995及993N或、Sikasil SG-18、Sikasil SG-20及Sikasil SG 500CN均可做为结构性密封胶材料。
   b. Products requiring mixing of components are acceptable only for shop application with mixing and applying equipment acceptable to the sealant manufacturer.
   若使用双组份结构胶，仅可于工厂内搅拌，且须采用结构胶制造商所认定的施工机具
4. Non-Staining Seals:
不污染性密封胶
   a. Non-staining sealant type shall be used at all exposed panel-to-panel joints.
   所有铝包板区域的外部接缝，若有采用密封胶时，必须使用不污染性密封胶
   b. Acceptable products (subject to tests): Dow Corning 991, Sikasil WS-605 S, Sikasil WS-355 or approved equal.
   可接受的产品（根据检测）：Dow Corning 991, Sikasil WS-605 S, Sikasil WS-355 or 同等的批准的材料均可做为结构性密封胶材料
5. Alternative Products:
替代材料
   a. Alternative products may be considered in accordance with Article 1.08.I.
   若欲采用其它密封胶，须符合本规范 1.08.I 的规定。
   b. Oil base sealants are not acceptable.
   不得使用油性(Oil base)的密封胶。

B. General Requirements.
一般规定

1. Locate and identify all sealants by product name and color on shop drawings.
在图面上须标出所有密封胶的使用位置，并注明其品牌、颜色及产品编号。

2. All sealing materials shall be applied by skilled mechanics specially trained and experienced in their use.
所有密封胶需由经过训练及有经验的人员施打。

3. In using specified sealants, strictly observe the printed instruction of sealant manufacturer regarding joint size limitations, backer rod, mixing, substrate cleaning, surface preparation, priming and application.
使用指定的密封胶或核准的同级品时，应严格遵守密封胶制造商对其接头尺寸的限制，搅拌、打底漆、施工等各方面的指示。

4. Prior to application of sealant material, thoroughly clean all mortar, dirt, dust, moisture and other foreign matter from all substrates to which sealant must bond. Use cleaning material as per manufacturer's printed instructions.
于密封胶施打前，完全清除所有泥浆、污物、灰尘、水气及其它附着物。使用密封胶制造商书面指示的清洁剂。

5. A primer shall be used, unless manufacturer's printed instructions advice to the contrary, and sealant manufacturer certifies that the use thereof will reduce its performance.
除非密封胶制造商说明使用底漆会降低黏着性，否则需使用底漆。

6. Sealant shall not be applied when substrates are wet or when the temperature is below 5ºC.
不可于潮湿的底材，或温度低于 5℃时打胶。

7. Sealant back-up materials shall be closed cell non-gassing backer rod as recommended by sealant manufacturer and as specified herein.
密封胶的背衬应采用不吸水，压缩时不透气的背衬材，依密封胶制造商的指示而定。

8. Adjoining surfaces shall be masked, when required, to maintain a clean and neat appearance. Sealing compounds shall be tooled to fill the joint and provide a smooth finish surface. All sealant shall be tooled as a separate operation after application
为了有干净及平整的外观，相邻的铝材和玻璃表面需贴胶带，所有密封胶施打完成时，于表面上需再加以修整。

9. Coordinate with other sections to assure compatibility of intersecting sealants.
详其它章节相关规定，确认其兼容性。

C. Color of Sealant
密封胶颜色

Provide colour of sealant including custom colours as selected by the Architect.
提供色卡（含定制颜色）由建筑师决定。

D. Structural Sealants.
结构性密封胶

1. Structural glazing: ASTM C 1401.
结构填缝: ASTM C 1401.

a. All joints, which are sealed with sealant as part of the fabrication, glazing or erection procedure, shall be sealed with an approved structural silicone sealant in approved color by the Architect, as manufactured by Dow Corning or Sika.

所有于制造、玻璃安装、或安装过程中使用密封胶加以密封的接缝皆需使用 Dow Corning、或 Sika 所出品的结构性密封胶，且其颜色亦须经建筑师核准。

b. Units shall not be moved until structural silicone seal has achieved full cure.
在结构性填缝材料未完全硬化的前，不应移动其所黏合的组件。

c. Care shall be exercised to insure against 'three sided adhesion'. Bond breakers shall be provided where necessary.
应小心防止发生三面黏着，必要时应采用防黏片(Bond Breaker)。

d. Clean, prime and mask at structural silicone joints during the same work day on which the silicone is applied.
结构性填缝材料施工时，须于同一天完成接缝的清洁、涂底漆、及贴胶布的工作。

e. Temporarily clamp glass during cure of structural silicone. After sufficient cure, remove clamps and fill any gaps in silicone.
以夹子暂时将涂满结构性密封胶的玻璃固定，当密封胶养生完成后，拔去夹子，再将空洞以密封胶填满。

f. Mask glass and aluminum during application of structural silicone. Remove masking immediately after tooling sealant.
玻璃及铝料上的胶带，于密封胶以抹刀整平后，必须立即去除。

g. Exterior flush joints at structural silicone conditions shall be sealed with silicone sealant.
玻璃密封时，若内侧为结构性密封胶，外侧接缝须采用同性质密封胶。

2. Aluminum finish at structural silicone
结构胶填缝处的铝料表面处理

a. Mill finish is not acceptable at structural silicone bonding surfaces.
以结构性填缝材料黏合的表面不可为光面铝材。

b. Aluminum surface to which structural silicone will be adhered shall have a finish, which demonstrates by test the ability to satisfy specified requirements. Subject to testing, acceptable alternatives are as follows:
欲以结构胶填缝材料黏合的表面，其处理方式应经过测试，说明其足以符合指定要求，经测试后，铝材的表面处理可为如下方式：

1) Kynar 500 paints conforming to AAMA 2605 or Qualicoat Class 3.
符合 AAMA 2605 或 Qualicoat 等级 3 要求的 Kynar 500。

2) Architectural Class I anodizing conforming to AAMA 611
符合 AAMA611 建筑等级 I 的发色处理。

3) Alodine conversion coating.
阳极氧化处理

E. Sealant Quality Control.
密封胶的质量控制

1. External Facade Contractor shall establish and submit for approval a Quality Plan to monitor quality of cleaners, primers, silicone sealant,

workmanship and adhesion of silicone sealant works. Program shall cover both initial testing of components for sealant adhesion/compatibility, etc., and also random testing of production run materials, etc. Quality Plan must include, but is not limited to, the following items:
外幕墙承包商应建立一套品管计划，控制清洁、底漆、密封胶、人工等的品质以及结构性密封胶的黏合力，并需将此品管计划送请核准，计划应涵盖构件与密封胶的黏合与兼容性的初测，以及后续的抽测，计划中至少须包括下列各项，但不仅限于此：

a. Factory flood testing of unitized panels for water leakage.
工厂单元注水测试(Flood Test)：

   1) One unit in the first ten (10) units produced.
   最初 10 个单元内抽测 1 件

   2) One unit in the next forty (40) units produced.
   后续 40 个单元内抽测 1 件

   3) One unit in the next fifty (50) units produced.
   后续 50 个单元内抽测 1 件

   4) One unit in every hundred (100) units produced.
   之后每 100 个单元内抽测 1 件

b. Deglazing test for structural sealant.
结构性密封胶的检验(Deglazing Test)

   1) One unit in the first ten (10) units produced.
   最初 10 个单元内抽测 1 件

   2) One unit in the next forty (40) units produced.
   后续 40 个单元内抽测 1 件

   3) One unit in the next fifty (50) units produced.
   后续 50 个单元内抽测 1 件

   4) One unit in every hundred (100) units produced.
   之后每 100 个单元内抽测 1 件

c. During production testing including butterfly test and snap test for two-part sealants, skin over and elastomeric test for one-part sealants. Butterfly test and snap test shall be performed at minimum each time the sealant pump is started/restarted. Skin over and elastomeric test shall be performed at minimum once per week and on each batch of one-part sealant.
密封胶施打期间需包含，双组份胶的蝴蝶及拉断测试，单组份胶的表面干燥及弹性测试。蝴蝶及拉断测试需于密封胶帮浦每次开始及重新开始时实施。单组份胶的表面干燥及弹性测试，需针对每一批号、每一星期实施一次。

d. The structural sealant batch numbers shall be tracked utilizing a system that shall enable identification of all units/areas where each batch of structural sealant has been used on the project.

每一批号结构性密封胶需建立追踪系统，追踪每一批号密封胶施打于那一单元及大楼的位置。

e. Periodically test sealants in place for adhesion, using methods recommended by sealant manufacturer and as per the approved External Facade Contractor's Quality Plan. Promptly replace any sealant, which does not adhere or fails to cure, External Facade Contractor to submit a method statement for approval by the Architect.
依据制造商的建议及外幕墙承包商核准品质计划，定期检查密封胶的黏着性。当密封胶无粘结性或无法硬化时，必须立即更换密封胶。外幕墙承包商须提供施工计划书予建筑师核准。

f. The manufacturer of each type of sealant shall be requested to render technical assistance prior to the application of a sealant, witness the first shop and job site applications, and also conduct periodic inspections as required. The External Facade Contractor shall witness and document inspections performed by the sealant manufacturer and provide close supervision of all labor used to apply sealants.
制造商于每一种密封胶施工前，必须提供技术性指导，视察工厂及工地第一次施工，并且定期实施各项检验。外幕墙承包商需见证及建立所有制造商实施的测试，并督导所有密封胶施工人员。

F. Sealant Testing and Certification.
密封胶的测试及证明文件

1. All Sealants:
所有密封胶

a. Use sealants and substrates only in combinations for which favorable adhesion and compatibility results have been obtained.
密封胶的种类必须符合黏着性及兼容性测试报告

b. The External Facade Contractor shall provide samples of actual production material for all relevant substrates to the sealant manufacturer for such tests. Samples shall be clearly labeled and identified for this project. The External Facade Contractor shall submit sealant manufacturer's written test reports, and recommendations regarding cleaning and priming for all sealant-substrate combinations on the project on the basis of testing. Testing shall be performed as follows:
承包商应提供来自密封胶制造商的证明；证明已审查及测试所有密封胶的接头，相接的表面材料，适用且兼容，并且不会沾污欲黏合的表面。上述有关兼容性、适用性及不会沾污的测试应以就欲使用的底材，依据适用的ASTM/BS程序进行测试，其中应包括下列资料：

1) Adhesion test data to production samples of metal and glass, tested in accordance with ASTM C 794, establishing adhesion over the temperature range as described under the performance criteria section of this specification.
依ASTM C 794测试程序，并依本规范的效能准则所说明的温度范围内，在金属及玻璃样品上做黏着性测试

2) Compatibility statement that the materials in contact with the sealant such as gaskets, spacers, setting blocks, are compatible with the sealant after twenty-one (21) days exposure to ultra violet, 2000 - 4000 (microwatt U.V. radiation). Test to ASTM C 1087 as modified.
兼容性声明─说明胶条(Gasket)、玻璃背衬(Spacer)、玻璃垫块(Setting Block)等与密封胶相接合后的材料在曝置于2000─4000微瓦紫外线辐射下21天后，仍与密封胶兼容。依据ASTM C 1087测试标准

c. All stone and painted finishes shall be tested for staining with each intended sealant. Testing shall conform to ASTM C 1248. An "h" type specimen shall be used with the sealant between two pieces of the test material. The sealant cross section shall be at least 12mm by 12mm. After the sealant has fully cured, subject at least on sealant surface to continuous exposure of 2000 microwatts per square centimeter minimum ultraviolet radiation for a minimum of fourteen (14) days. Note any staining of substrate. Then compress sealant to 50 percent of its original thickness and place the compressed specimen in an oven at 70 degrees c (+/- 5 degrees c) for 14 days. Cool specimen for one day. Examine the test materials for staining at their surfaces, and break them in two to examine for internal staining. Any surface or internal staining shall be reported and shall be cause for rejection of the sealant. Submit sealant manufacturer's written test reports.
石材及烤漆表面需实施污染性测验。密封胶需置于两片基材中央且成'H'型，密封胶的断面至少为12 X 12mm，待密封胶养生后，将密封胶相接合后的材料在曝置于2000微瓦紫外线辐射下14天，纪录基材污染状况。然后将密封胶压缩50%，并将试体置于70℃(±5℃)的烤箱14天，冷却一天后，纪录基材表面污染状况，并将基材折断纪录基材内部污染状况。基材表面及基材内部若有污染状况，则此密封胶不可使用。外幕墙承包商须提供制造商的书面报告

d. Provide seven (7) days water immersion test for sealant adhesion.
针对黏着性，提供7天泡水试验

e. The External Facade Contractor shall provide certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details on the shop drawings and finds same suitable and acceptable for intended application.
外幕墙承包商须提供证明，说明制造商已审核施工图且认可施工方式

2. Structural Sealants:
结构性密封胶

a. External Facade Contractor shall provide additional certification from sealant manufacturer:
外幕墙承包商须提供制造商额外的证明

1) Stress statement that for the sealant dimensions (per shop details) when exposed to the specified wind load, the stress on

the silicone sealant does not exceed 0.14MPa
应力声明—将依施工厂图上密封胶的尺寸置于指定的风力负载下时，密封胶所承受的应力不超过 0.14Mpa.

b. Where structural silicone bonds to a metal or glass surface, the weakest element in the line of stress must have a minimum strength of 0.35MPa. For each combination of substrates submit report from an independent laboratory for tests performed in the following manner:
以结构性密封胶黏合金属或玻璃面时，在受力线上的较弱构件必需具有最小 0.35MPa 的强度，且各类基材组合的测试报告，须来自一独立实验室的测试报告，测试的程序应依下列方式进行：

1) Assemble and fully cure a minimum of 6 samples using actual substrates and a minimum sample length of 125mm.
至少组合 6 件完全硬化的样品，需使用实际欲用的底材，最小样品长度为 125mm。

2) Subject sample to a tensile load such that nominal stress on silicone is 20psi (0.14MPa); hold for one (1) minute and remove load. Repeat for additional loadings, increasing nominal silicone stress by 5psi (0.035MPa) with each successive loading. Continue until failure occurs or until 120psi (0.83MPa) is successfully applied.
将样品置于 20psi (0.14MPa)张力负载下，维持一分钟后，移去负载，重复进行上述步骤，但每次皆增加 5psi (0.035MPa)的负载。使作用于样品的负载逐次增加，持续进行至密封胶失效，或负载达 120psi (0.83MPa)为止。

3) All6 samples shall successfully withstand at least 50psi (0.35MPa) over the temperature range as described under the performance criteria section of this specification. Report maximum stress and mode of failure. If one or more samples do not meet these criteria, revise failed element and repeat tests with 6 new samples. Repeat until all 6 samples are successfully tested.
6 件样品在本规范所指定的温度范围内，至少皆需能承受 50psi (0.35MPa) 的应力，报告中应记录最大应力及失败的模式，如有一或多件样品未能合格，应修改失败的样品，再以新的 6 件样品送验，直至 6 件皆能合格为止。

4) Prepare an outline for evaluation of adhesion and other physical attributes of sealants and submit to the Main Contractor, Architect and Consultant for review.
准备一份评估报告，评估密封胶的黏合力及其它物理性质，并送交总包、建筑师及顾问审阅。

2.06 FABRICATION 加工及制造

A. General
一般说明

1. All parts of the work shall be of the materials, design, sizes and thickness herein specified or as may be required to meet the aesthetic intent and performance criteria. Methods of fabrication and assembly, however, unless otherwise specifically stated, shall be at the discretion of the contractor and subject to acceptance by the Client Representative with submitted shop drawings and calculations prior to any fabrication. Remedial measures, which may be necessary on the visual and performance mock-ups and on the building, shall maintain standards of quality and durability and are subjected to acceptance by the Client Representative.
本工程所有组件的材质，设计，尺寸及厚度，皆需符合本规范效能准则及建筑外观及的需求。除非另有声明，制造及组合的方式则由外幕墙承包商自行决定，但需于制造前送审图面及结构计算，且为业主代表所接受。视觉模型和性能模型试验及本工程中的修正补强其品质及稳定性须符合标准，且为业主代表所接受。

2. Fabricate steel members in accordance with AISC Specification for Structural Steel Buildings.
铁材构件的加工应符合 AISC 建筑物的结构钢材规范。

B. Workmanship
工艺

1. All work shall be done by competent workmen thoroughly skilled in the trade. Use no materials, equipment or practices that may adversely affect the functioning, appearance and durability of the completed work and related construction. The work shall be accomplished in compliance with the specified criteria without buckling, opening of joints, undue stress on fasteners, sealants and gaskets, opening of welds, cracking of glass, leakage, noises or other harmful effects.
所有工程皆应由合格且熟练的工人进行，工程进行时，不可使用会对成品及相关工程的功能、外观、及耐用性产生不利效应的材料，设备及施工程序，应依本工程指定的准则完成，不可有挫曲、接头分开、焊接处分开。固定件、密封胶及垫片上有不当的应力、玻璃破裂、漏水、噪音或其它的不良现象。

C. Joints in Metal Work
金属组件的接头

1. All exposed work shall be carefully matched to produce continuity of color, line and design and all joints, unless otherwise shown or specified, shall be accurately fitted and rigidly secured. Exposed cut edges shall be treated or sealed to prevent any cut edge corrosion to the coating. Any exposed edges shall be finished to match face of work (i.e. edges of mullions at expansion joints, etc.). Joinery intended to be "in plane" shall not vary from true alignment by more than 0.8mm. Offset in glazing rabbet shall not be greater than 0.8mm.
所有外露工程皆需仔细配合，以形成连续的线性，所有接头除非另有指定，亦应精确安装，妥善固定。外露的边缘应该处理或者密封以防止边缘锈蚀影响涂层。所有外露边缘亦应修整，使其能与邻接表面配

合(如接缝处相邻的直料外缘)，设计为同平面的细部工程的起伏不得超过 0.8mm，玻璃接缝槽的偏置量亦不得超过 0.8mm。

2. All joint intersections to be buttered with sealant prior to assembly, then fillet sealed on non-exposed areas or application of sealant tape of NORSEAL V710 and seal all screw penetration heads.
所有接头须于组装的前先填上密封胶，组装完成后因挤压附着于外露面的密封胶须予以擦拭干净，未外露部份则须再施打密封胶，再予以抹平。亦可采用防水胶布(NORSEAL V710)，并于螺丝头处施打密封胶密封。

3. No visible sealant at canopy, beam fascias, and soffits will be permitted.
雨蓬、梁、立面板和吊顶板表面不能有可视浮胶。

4. Pre-assembled inside and outside corners at Louvers, glass walls etc. must utilize alignment keys and corner splices.
预先组合的百叶窗框及玻璃框，于转角接合处，必须有连结块(corner splices and alignment keys)。

D. Shop Assembly.
工厂组装

1. As far as practicable, all fitting and assembly work shall be done in the shop with pre-assembled corner units as shown on drawings.
本工程的所有材料，皆需于工厂内部组装完成。

E. Exposed Fasteners.
外露的固定件

1. Exposed fasteners on finished surfaces will not be permitted unless otherwise shown on the approved drawings, or specified. All decorative (exposed) fasteners to be submitted for the Client Representative's approval.
除非核准的图式，或经另行指定，所有螺丝及固定件不得外露。所有外露的装饰螺丝及固定件，必须为业主代表所核准。

F. Protection of Metals
金属的保护

1. Protection against galvanic action shall be provided wherever dissimilar metals are in contact, except in the case of aluminum in contact with stainless steel. This protection shall be provided by any of the following:
除铝与不锈钢接触的情况外，相异金属接触时，皆需提供电位差(Galvanic Action)对金属所产生伤害的保护措施：

   a. Painting the contact surfaces with two heavy coats of bituminous paint
   接触表面涂上二层高浓度的沥青漆。

   b. Application of MDS filled nylon spacers or
   MDS 尼龙片

   c. An appropriate sealant or tape or other approved galvanic isolator.
   使用适当的密封胶，胶带，或核准的静电绝缘材料。

2. All metals, except stainless steel, which are to be in contact with concrete, mortar or plaster, shall have the contact surfaces protected with two heavy coats of bituminous paint.
除不锈钢外的所有金属,如需与混凝土灰泥或胶泥接触，其接触表面皆应以须涂上二层高浓度的沥青漆。

G. Welding
焊接

1. All welding shall be done in accordance with pertinent recommendations of the AWS D1.1 and the Suzhou building authority requirements
所有焊接工作皆需依照相关的美国焊接协会 D1.1，中国苏州建筑部门的规定程序进行。

2. All welding shall be performed by skilled, qualified and certified mechanics. All welders shall be certified by local authority. Certificates shall be submitted to Client Representative and Consultant for record prior to proceeding with welding works.
所有焊接工作应由熟练且领有执照或检核合格的工人施作。外幕墙承包商于施工前，须提供所有技工的执照予业主代表及顾问。

3. All welding shall be performed with electrodes and methods recommended by the suppliers of the metals being welded.
采用焊条供货商所建议使用的电极及程序进行焊接工作

4. Type, size and minimum length of all welds shall be shown on the approved shop drawings and structural calculations.
所有焊接型式、尺寸及长度，必须标示于施工图及结构计算。

5. Welding to galvanized surfaces shall not be permitted.
镀锌表面不可焊接。

6. Welds behind finished surfaces shall be done in such manner as to not cause distortion "weld telegraphing" or discoloration on the finished side. Weld spatter and welding oxides on finished surfaces will not be permitted. Welding on exposed surfaces is prohibited. Welding at finished exposed areas may not cause distortion, dimpling and deformation of any kind.
焊接的型式、尺寸及间隔皆应依照核准施工图上的规定，完成表面处理的材料其背面的焊接不可造成其表面的变形及褪色，且其表面上亦不得有焊接及焊接的氧化物，在外露表面上不得采用焊接。焊接完成后，对于外露区域不应造成任何扭曲变形影响。

7. All steel-to-steel welds shall be wire brushed to remove scale and painted with two (2) heavy coats of zinc rich primer in differing colors.

所有钢材的焊接处应以钢丝刷除去残屑，并涂上二层不同颜色，含高浓度的锌粉底漆。

8. Special care shall be taken to protect glass and other finished surfaces from weld spatter.

玻璃及其它完成的表面，必须提供保护，避免因焊接而受损。

9. Where field welding to embeds occurs, the embed thickness shall not be less than 8mm (0.312”)

当预埋铁件需于工地焊接时，预埋铁件的厚度不可小于 8mm（0.312”）。

10. Fillet welds are not permitted as a means of attaching stud type members (i.e., headed studs, deformed bars, threaded rods) to insert plates, only full penetration welds to end of studs are accepted and must be made with a machine specifically designed to weld studs to insert plates.
植钉类不可以填角焊焊至预埋铁件上，如带头植钉、圆棒及螺杆等。仅可使用特制机具将植钉焊至预埋铁件。

11. External FaçadeContractor to submit weld testing procedure for Client Representative and Consultant’s approval. Welding shall not commence until the quality procedures are approved. Weld testing and inspection shall be performed by a qualified and approved independent third party. Weld testing and inspection shall conform to requirements of referenced standards and local building authority and shall not be less than the following:
所有焊接测试步骤须由业主代表及顾问核准，所有焊接于品管步骤核准前不得进行。测试须由独立且经核准的实验室进行，焊接测试须符合相关标准的规定，或政府建筑部门的要求，且不得少于下列要求。

    a. 100% visual inspection.
    100%目视检验

    b. 20% Magnetic Particle Inspection (MPI) testing of all fillet welds.
    填角焊，20%MPI 测试

    c. 100% MPI and Ultrasonic Testing (UT) of all full-penetration butt welds.
    全渗透对焊（Full-penetration butt weld），100%MPI 及 UT 测试

    d. 20% MPI and UT testing of all partial-penetration butt welds.
    部分渗透对焊（Partial-penetration butt weld），20%MPI 及 UT 测试

    e. All welding inspection and testing reports shall be signed by the qualified welding inspector and submitted for record.
    所有测试报告须由合格检验人员签署并送审。

H. Shop Painting of Carbon Steel.
碳钢的厂内上漆

1. Items of carbon steel, unless galvanized after fabrication or scheduled for other finish shall, after completion of fabrication and welding, be thoroughly cleaned of all loose scale, filings, dirt and other foreign matter and shall be painted with two coats of zinc rich primer in two different colors. (See steel finishing Article 2.02 – paragraph H).
除制造后已经电镀或已安排作其它表面处理外，碳钢类项目在完成制造及焊接后，应彻底清除残渣、灰尘、焊药及其它异物，再涂上二层不同颜色含高浓度的锌底漆。详2.02.H室外及室内钢料构件的表面处理

I. Use of Sealing Materials.
填缝材料的使用

1. As per Article 2.05.

符合2.05的规定

2.07 EARTHING/LIGHTNING CONDUCTOR FOR EXTERNAL FACADE SYTEMS AND PANEL CLADDING 幕墙系统及面板覆层的接地/避雷装置

A. Comply with the latest section of COP for the Electricity (Wiring) Regulations, the IEE Regulations (BS7671), BS EN 62305 Building Lightning Protection Design Code (GB 50057-94), Civil Electrical Design Regulations (JGJ18-2008): and coordinate and agree application with the Electrical Engineers and the Electrical Sub-contractor for the location of all earthing/lightning connections and provide connection provisions.

符合最新的 COP 电（线）规范，IEE 规范（BS7671），BS EN 62305，建筑物防雷设计规范(GB 50057-94)，民用建筑电气设计规范(JGJ18-2008)和地方当局的要求，并与电机工程师和所有提供接线供应及与接地/避雷装置有关的电子子转承包商配合取得一致意见。

B. The sections of the extrusions making up the window framing and cladding system shall be in sound mechanical contact with each other to form a low electrical resistance. Continuity straps shall be used if necessary.

窗框就和覆层系统的型材必须以闭合回路的方式连接使之形成低电阻，如果有必要的话在连接处要使用带状连接

C. External Facade Systems and cladding framing members shall be bonded in compliance with the COP for Electricity (Wiring) Regulations.
幕墙系统及其框就构件必须遵从电子（电线）规范中的规定接地

PART 3 – EXECUTION
第三部分 – 施工

3.01 EXAMINATION 检查

A. After lines and grades have been established, (Main Contractor will provide basic control lines and one bench mark on each floor.) and before beginning installation in any area, the External Facade Contractor shall examine all parts of the structure on which the work is to be placed in that area. Should any conditions be found which, in his opinion, would prevent the proper execution of his work, he shall report such conditions in writing to the Main Contractor. Installation work shall not proceed in that area until an agreement is reached on how the work will be adjusted to the satisfaction of the Main Contractor and the Architect.
在基准点及标线设定完成之后(总承包商应提供基本控制基准线及每层楼的水准点)，外幕墙承包商不可在任何区域进行安装工程，应检查欲施工区域的所有部分，如发现并认为某一状况足以影响工程的顺利进行，应即以书面向总承包商报告，该区域的工程在未与总承包商及业主代表取得修改上的协议前，不得进行

B. Coordinate work with that of other trades. Report any errors, omissions or inconsistencies by other trades and request direction before proceeding. Promptly furnish items that shall be placed during the installation of other work.
外幕墙承包商负责与其它相关工程的一切沟通协调工作，并告知总承包商所有错误、遗漏与不一致处，在未取得任何指示前，不得进行任何工作。于其它工程施工时，须立即将上述问题解决

3.02 INSTALLATION 组装及安装

A. Postponement of complete enclosure.
延迟施工

1. If so directed by the Main Contractor, installation of the work shall be postponed in any area, to facilitate moving material into and out of the building during construction. Provide alternate detailing required allowing for a two-module wide opening by one module high area to be completed at a later date in two locations so as to allow for a material and personnel hoists. This detailing shall include provision for a “removable” vertical mullion at the midpoint of the opening that can be installed as a “come back” item once the hoist or hoists have been removed. This detail shall also allow for the glazing of the four vision lites at a later date when the hoists are removed.
在施工期间，为了材料顺畅进出建筑物，在总包所指示的区域，幕墙的安装应延后。提供预备详细方案以便允许2处2个单元宽、1个模数高的开口部位的幕墙后装，便于设置材料人员进出的施工电梯。该处节点应在开口中部设置可移动的垂直龙骨并且该龙骨可以在施工电梯拆除后重新安装。该处节点应允许4个可视区面板在施工电梯拆除后安装

B. Qualification of workmen.
合格工人

1. All work shall be performed by skilled workmen, especially trained and experienced in this type of work.
所有工程皆应由熟练、特别训练且具此类工程经验的工人施工。

C. Lines and Grades.
标线

1. Bench marks will be established on each floor by the Main Contractor. But building line offset marks for alignment on each floor shall be established by this External Facade Contractor. Should any error be found, the External Facade Contractor shall notify the Main Contractor/Architect in writing, and installation work shall not proceed in the affected areas until the errors have been corrected. The External Facade Contractor shall provide a layout team through out installation.
总承包商将在建筑物的每一层楼建立水准点，而外幕墙承包商须自行在建筑物各层楼建立标线，并需为其精确度负责，如发生任何错误，外幕墙承包商需以书面通知总包和业主，受影响区域的工程在错误未得到纠正前，不得继续进行施工。外幕墙承包商应于整个安装工程中拥有一支测量队伍

D. Welding.
焊接

1. As per Article 2.06.paragraph G.
符合2.06.G的规定

E. Use of Sealing Materials.
密封胶的使用

1. As per Article 2.05.
符合2.05的规定

F. Anchorage.
锚接

1. Anchorage of the work to the structure shall be by approved methods in strict accordance with approved shop and/or erection drawings. Supporting brackets shall be so designed as to provide three-dimensional adjustment and accurate location of all components. After the unit is properly positioned, all connections so designated on approved shop drawings shall be rigidly fixed by welding or other positive means.
本工程与建筑物结构的锚接需采用认可的方法，并需严格依照核准的施工图进行，支撑构架的设计应能为所有构件提供三向调整及精确定位，当组件正确定位后，即应依核准施工图上的指定，以焊接或其它有效方式，将各组件确实固定。

2. Remove weld slags and apply prime paint (zinc chromate) or (dry gal) over welds. Also paint exposed portions of inserts. Touch up shop applied paint that is damaged by welding or other causes.
电焊完成后，须清除焊道上所有焊屑，并涂上二层防锈底漆，任何外露的预埋件，及已完成表面处理却有因电焊或其它因素破坏其表面处理构件，皆须再涂上二层防锈漆。（使用前面批准的油漆和上漆方法，见2.02章节

3. Where slots or oversize holes are provided for adjustment only, secure the connection after final adjustment. Interlocking serrations in extruded aluminum brackets and washers are acceptable. Steel weld washers with 0.25-inch minimum thickness are acceptable with steel brackets. Special washers or nuts, which rely on friction and/or surface indentation of the fastened part, are not acceptable.
构件上细长的孔或因调整而将螺丝孔加大时，须于调整完成后，于连接处完全固定。将锯齿状的铝型材构件与垫圈相互连接固定方式是许可的。若采用钢铁材质的垫圈电焊固定时，其厚度至少须为0.25英寸（6.35mm）。仅采用摩擦接触的垫圈或螺帽，或不平整的构件表面为固定锚接方式，不得采用于本工程中

G. Insulation/fire safing installation
保温棉／层间塞的安装

1. Install fire stop and safing insulation in locations shown on drawings and in accordance with Article 2.03.B.
层间塞应依照图标安装，并符合 2.03.B 的规定。

2. Thermal insulation shall be discontinued vertically at fire safing locations and replaced with safing insulation.
保温棉与层间塞接触处，需更换为层间塞材料。

3. Fire safing insulation thickness shall be maintained around all mullions and anchor locations.
竖料和锚件处，层间防火棉必须维持最小厚度。

H. Field Installation of Preglazed Panels
玻璃预先组装板块的现场安装

1. Inspect each preglazed unit immediately before installation and eliminate pieces which have observable edge damage or face imperfections.

现场安装前应对每一个预先组装的板块进行检查，并将边部及表面有瑕疵的板块剔除。

2. Check frames to receive units for squareness and trueness. Verify that perimeter clearances are sufficient to prevent "point loading" and that surfaces are clean, dry, and ready to receive preglazed units. Verify that frame corners are weather tight and that sills are drained to outdoors. Remove all protective coatings from framing surfaces.

复查支撑板块的矩形度。避免在周边出现局部点荷载的出现，并且确保其表面是干净的、干燥的并且可以接受预先安装的玻璃板块。确保板块框架四周转角部位的水密性及在窗台部位可以将水排出到室外。从框架上去除保护膜层。

3. Watertight and airtight installation of each preglazed unit is required. Each installation must withstand failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

每一个预安装板块的水密和气密需要满足要求。每一个板块的安装应

没有任何失误，包括玻璃的破碎，密封胶或胶条的开裂，以便确保水密性及气密性，玻璃材料的退化或其他缺陷。

4. Preglazed units shall be stored in a dry, well-ventilated location. Handling of glass shall be kept to a minimum, and all glass shall be carefully protected from soiling and from condensation.

   预先组装的单元应存储与干燥，并且通风的地方。尽量少对玻璃进行处理，所有玻璃应避免弄脏或结露。

5. Gaskets shall be vulcanized (injection molded) at corners where compatible with installation procedure. Where gasket joints occur, tightly butt end and seal with a compatible sealant.

   胶条在转角部位应采用满足安装步骤的注入方式。胶条连接的部位应密缝连接并采用兼容的密封胶密封。

6. Thoroughly clean glazing pocket before setting glass. Solvents shall be compatible with finished aluminium, glass and glazing materials. Place setting blocks at quarter points. Place side blocks in the upper half of each jamb, where required. Side blocks, setting blocks and chairs shall be positively retained in position.

   在安装玻璃前应彻底清理玻璃槽口，清洗剂应与铝型材表面处理、玻璃及密封胶兼容。在四分之一处设置垫块，在侧面上部设置侧面垫块。侧面垫块、垫块及其支座应设置在正确的位置。

7. Remove and replace stops and apply sealants as required for a complete glass installation. Details of installation shall permit replacement of glass after the construction period.

   根据完成玻璃安装的需要来移除和更换并打胶。详细的安装可以在施工阶段完成后进行玻璃的更换。

8. Each and every piece of glass shall be subject to Architect or Facade Consultant's approval, and any piece or pieces may be rejected after having been set or erected. Rejected glass shall be carefully removed and replaced with new suitable glass without delay and without cost to the Owner. Any piece or pieces damaged in the removal and resetting of defective or rejected pieces shall also be removed, with new and acceptable pieces provide and set at no cost to the Owner.

   所有的玻璃应由建筑师或幕墙顾问审核通过，即便是已经组装好或吊装好的玻璃也可能被驳回。驳回的玻璃应小心的拆除并从新更换为满足要求的玻璃，并且不能延误工期和对业主提出相关费用。任何在更换过程中导致的损坏也将被移除并更换，并不能向业主提出相关费用。

I. Field Glazing
现场打胶玻璃

1. Field glazing is not acceptable for the typical exterior wall. Non-typical areas or other areas requiring field glazing may, upon approval by the Architect or Facade Consultant.

   标准部位的外幕墙不允许现场打胶固定玻璃。非标准部位或其他需要现场打胶固定玻璃的地方需要由建筑师及幕墙顾问审批通过。

2. Inspect each piece of glass immediately before installation and eliminate pieces which have observable edge damage or face imperfections.

在安装前检查每一块玻璃，如有可以看到的损坏或表面瑕疵，应立即将其剔除。

3.03 TOLERANCES 容许误差

A. Workmanship.
工艺

1. All parts of the work shall be erected, plumb and true, in proper alignment and relation to established lines and grades, and as shown on approved shop and/or erection drawings.
本工程所有组件的安装应基准已建立的水准点和标线，且应依照核准的施工图进行施工。

B. Erection Tolerances.
安装的容许误差

1. Dimensional variation in the building frame and/or work surrounding or supporting the work of this section is as determined in the field-by-field measurement of the work in place.
建筑结构及工程周围的尺寸变动由现场测量决定

2. The work shall be designed to accommodate all tolerances and anticipated dead and live load movement, thermal movements, creep, sway and torsion of the structure without any harmful effects. All parts of the work, when completed, shall be within the following tolerances, and shall remain so during the life of the building:
本工程的设计必需能适应指定偏差和预期的自重和活荷载下的移动、温差变位、徐变、震动、摇动及扭曲变形，不会对结构产生不利的影响，本工程的各部份完工之后，其误差应符合下列要求，且于建筑物使用寿命内误差不得超过容许范围

   a. Maximum variation from plane or location shown on approved shop drawings: 3.2mm per 3660mm of length, 6.4mm per 9140mm length, or 10mm in any total building length or portion thereof.
   核准施工图所示位置与实际位置的最大偏差为：每3660mm为3.2mm，每9140mm为6.4mm，或本建筑物总长或其部分而言，则最大偏差为10mm

   b. Maximum offset from true alignment between two members abutting end-to-end, edge-to-edge in line or separated by less than 75mm and shall not exceed 0.8mm (shop and/or field joints). This limiting condition shall prevail under both no load and full load conditions.
   当头尾相接或两边并接，或相隔75mm以下的相邻构件，其距离实际对齐面的最大偏移量不应超过0.8mm。在无荷载或全荷载下，本限制条件皆适用。

   c. Maximum variation in the width of a joint between two (2) adjacent panels or between a mullion and an adjacent panel shall be ±1.0mm.
   两相邻的铝板或竖料与和近铝板的接头宽度最大误差应在±1.0mm 内

C. Construction Tolerances :
施工误差

1. Construction Tolerance values specified in this section are used in designing the Concrete Wall System, and shall be confirmed as per Structural Engineer/ Architect design considerations.
本节说明的施工误差值是针对主体混凝土墙体系统的，应与结构工程师/建筑师的考虑一致。

a. Perimeter concrete/beam slab edge variation from plumb:
周边混凝土/梁板边线到控制线的变化

i. in any 3 meter length : 8 mm
在任何3米长度内：8mm

ii. maximum for entire length H/1000 and ≤30 mm
总长度内最大值为H/1000和小于30mm

b. Perimeter concrete/beam slab edge variation from level:
周边混凝土/梁板边缘到水平控制线的变化

i. in any 3 meter length : 10 mm
在任何3米长度内：10mm

ii. maximum for entire length ±30 mm
总长度内最大值±30 mm

c. In and out construction tolerance: ±25 mm (to be confirmed)
内外施工误差：±25 mm

d. Variation in linear building lines from established position in plan: ±20 mm for Podium, ±10 mm for Tower.
从平面控制点到建筑线的变化：裙楼为±20 mm，塔楼为±10 mm

2. Fabrication tolerance: 0.5 as commonly practiced:
加工误差：通常0.5mm

3.04 FIELD QUALITY CONTROL 工地品质管制

A. Field water testing in accordance with Article 1.13- paragraph A.
依本规范1.13A实施现场防水测试。

B. External Facade Contractor shall provide external access for executing field water testing and inspection monitoring of workmanship during the construction phases of the project.
在项目施工阶段，外幕墙承包商提供在外部执行现场防水测试，并且检查工地施工工艺。

C. External Facade Contractor shall provide external access and assistance for independent consultants and architects' representatives for inspection of all site installation work, in particular, the fixing of spandrel units at and below floor level.
外幕墙承包商应为独立顾问和建筑师代表进行现场安装工作特别是对在下部楼层固定层间板块时，提供外部条件。

3.05 MANUFACTURER'S FIELD SERVICES 厂商在工地所提供的服务

A. External Facade Contractor shall provide field surveillance of the installation of work under this section. Any condition or installation at variance from approved shop drawings shall be duly noted and incorporated into the 'as-built' drawings.
外幕墙承包商应对本节工程的安装工程进行监督，任何偏离核准施工图的状况或安装皆应适时记录，并列入竣工图中

3.06 PROTECTION AND CLEANING 保护及清洁

A. Protection of the work is the responsibility of the External Facade Contractor. All material shall be appropriately packaged and handled through transit, staging, storage, and installation to avoid damage.
本工程保护工作由外幕墙承包商负责。所有材料必须适当包装、运输、吊放、储存及安装，以避免由于其他工作引起的所有幕墙材料及其安装损坏

B. The External Facade Contractor is tasked to provide of a protective covering to all exposed members/ components including the interior face of the glass.
外幕墙承包商应该对所有外露部分/构件包括室内玻璃表面进行表面覆盖防护

C. When there is a need for clean water to wash the wall down, no diluted acids, etc., should be permitted even if in 1:10 ratio for fear of etching glass. If anything other than potable water and soft scrub brushes is used in each wall component including but not limited to glass, gaskets, sealants, paints, etc., said materials need to be tested.
如果外墙需要清洁时，必须使用非酸性水，避免对外墙材料造成腐蚀。所有非饮用水必须于清洁前测试

D. For job site storage and work in place, reasonable physical protection and markers shall be provided and timely notice given to the Main Contractor and other trades to which this work is exposed.
现场存放的器材及施工中的项目必须提供合理的保护及警告标示。外幕墙承包商须将保护措施及警告标示实时通知营造厂及邻近工程的承包厂商

E. Damaged or deteriorated materials shall be removed from site.
所有破坏或变形的材料应搬离现场

F. The External Facade Contractor shall allow for the provision of a temporary BMU for field water tests and cleaning of completed work for different sections of work. The temporary BMU provided shall be utilized for regular cleaning of the curtain wall after TOP of different sections of the work.
外幕墙承包商应承担现场淋水试验和各工作立面完工后清洁工作所用临时擦窗机的保护工作。临时擦窗机应该安装在现场最高处进行常规清洁工作

G. The External Façade Contractor shall remove all protective films, temporary labels, stickers, and tags (both exposed and unexposed to view) and any markings exposed to view prior to final cleaning. Final cleaning of the Works to be by others.
在最终的清洁前，外幕墙承包商须移除所有保护膜、临时标签、贴纸及标牌（包括外露的以及不外露的表面）以及其他可见的标记。最终的情节由其他单位完成。

H. For maintenance cleaning, glass façade shall be applied with Glass PreCleaner RV-01 as manufactured by Renovio except for etched or sandblasted side of glass. Glass PreCleaner shall be applied based on manufacturer's recommendation as follows.
关于清洁，除了玻璃被侵蚀或喷砂的部分外，玻璃幕墙应使用Renovio制造的Glass PreCleaner RV-01。Glass PreCleaner的使用应根据制造商的建议，如下：

1. Before application, glass surface must be free of dirt, dust and sand. Test first in a small area to see if the results meet the expectations. Application temperature should be between 5°C to 35°C.
使用前，玻璃表面应保持干净，没有泥土、灰尘和沙粒。首先在一小块区域测试清洁效果。温度应保持在5°C 至 35°C。

2. Shake well and apply the undiluted Glass PreCleaner using a soft cloth or soft nylon pad.
使用Glass PreCleaner时不能将其稀释，并且须摇匀，用软布或软尼龙布擦拭。

3. Manually spread the Glass PreCleaner on the concerned areas until contamination has disappeared completely. Thoroughly rinse the surface and dry if necessary.
将Glass PreCleaner在清洁区域均匀擦拭，直至污渍完全消失。其后充分冲洗表面，如有需要，将其擦干。

4. For quality and safety regulations follow the manufacturer's recommendations. Refer to technical and safety data sheets.
质量及安全规范参考制造商建议。参考技术及安全参数表。

I. The External Facade Contractor shall provide 2 times cleaning services for the curtain wall both indoor and outside after the construction completed and before hand over to owner.

幕墙承包商应分别在竣工后和交付业主前提供两次幕墙室内外的清洗保洁服务。

3.07 PROTECTION OF FINISHED WORK 完工后的保护

A. Protection of the work after installation against damage by other trades, as well as cleaning other than as required, shall be the responsibility of the External Facade Contractor.
安装完成后的幕墙应适当保护，避免在其它工程施工时遭到破坏，及本文所指定的大面和细部的清洁，皆为外幕墙承包商的责任

3.08 GLAZING 现场镶嵌玻璃

A. Before glazing, openings shall be checked to see that they are square, plumb and true plane. If found otherwise, glazing shall not proceed until proper corrections are made. Correct glass sizes to insure adequate "glass bite" shall be verified by field measurements. Glass shall be installed and blocked in such manner to assure proper "glass bite" on all sides.

进行镶嵌的前，应检查开口，确定其为方型，且玻璃沟槽在同一平面上，否则应等到经过适当修正后，才可开始镶嵌工作。玻璃的尺寸，应以工地现场的尺寸为主，以确保适当咬合，玻璃安装及固定须完全咬合

B. No glass shall be cut after leaving the factory.
玻璃离厂后，即不得再予以切割

C. Where holes are required to be formed in glass, they shall be completed in factory conditions.
所有玻璃表面开孔均应在厂房内完成

D. Perimeter clearance shall be sufficient to avoid all point loading and provide for jamb blocking.
应留有足够的周边空隙，以避免造成单点负载状况，以利于在边框加垫块。

E. Furnish detailed instructions for installation of glass. Instructions and explanatory details shall include sequence of installation, method of installation for materials (including glass, glazing gaskets, setting blocks, jamb blocks, etc.), and location of specific items such as the setting blocks and jamb blocks and any special instructions that may be required.
提供玻璃安装说明，其中细节应包括安装顺序、材料安装方法(玻璃、胶条、垫块、侧向垫块)，上述项目的相关位置与其它特殊的必要说明。

F. Weep-holes and drainage channels shall be unobstructed and free of dirt, rubbish, sealants and other foreign materials. As required by job conditions, clean or vacuum all glazing rabbets free of debris prior to all glazing operations.
排水孔及排水槽必须通畅无阻，避免灰尘、垃圾、密封胶及其它物质堆积，并依现场情况于玻璃镶嵌的前清洁及清除玻璃槽沟内的杂物。

3.09 REMOVAL OF DEBRIS 垃圾的移除

A. The External Facade Contractor shall provide a periodic clean up for the removal of debris, as agreed upon with the Terms and Condition binds in the Contracts.
外幕墙承包商应根据合同内同意的条款提供定期的清洁，以便清理垃圾。

B. After completion of every stage of work done daily by the External Façade Contractor, any accumulated shipped materials and scrap / debris shall be removed from the job site for proper disposal at designated area as directed by the Project Engineer of the Main Contractor.
在外幕墙承包商每天完成每一个阶段工作后，任何堆积的材料和垃圾应从现场移出以便在项目总包指定的区域合理处置。

3.10 MAINTENANCE PERIOD 维修期限

A. Visually inspect the structural silicone seal at the end of six months, one year and two years. Inspection shall take place in the presence of the Architect. Remove ten (10) samples of the internal structural silicone for testing. Re-seal the resulting holes with new and compatible silicone. Sealant manufacturer shall test and report in writing the condition of the sealant.
完工后的半年、一年及二年，应在业主代表陪同下以目视检查结构性密封胶，取10个内部结构硅胶样本做测试，并以兼容的密封胶填补缺口，密封胶承包商应测试并提出报告。

3.11 MAINTENANCE MANUAL 维护手册

A. Submit to the Architect, five (5) copies of 'as built' shop drawings and an assembled and bound maintenance manual, describing the materials, devices and procedures that shall be followed in cleaning and maintaining the work, including metal alloys, finishes, glass, sealants, gaskets and all other major components.
外幕墙承包商需提供给业主代表5份经核准过的竣工图及装订好的维护手册，说明工程的清洁及维护所需的材料、设备及程序，另应附有制造商的说明手册，说明工程中实际使用的材料，包括金属合金、表面处理、玻璃、密封胶、垫片及所有其它的主构件，并明列所有制造商的联系人、地址、电话等资料

B. Hard copies of the 'as built' shop drawings shall be signed by an authorized person of the sub-contractor and have the company chop applied. Soft copies of the completed maintenance manual and 'as built' drawings are to be provided.
完工施工图的纸质拷贝应由承包商授权人进行签署并加盖公司章。并应提供软拷贝的维护手册和完工施工图。

C. The maintenance manual shall include a section describing procedures for replacement of glass in the field for each type of glass and glazing condition including operable sash and spandrel glass.
此手册应包含一份现场更换各式玻璃、推开窗、楼板玻璃镶嵌情况及各式铝板更换的程序说明书。

D. Instruct the Owner's personnel who will be responsible for window washing after the time of final acceptance. Demonstrate, and train Owner's personnel, for a period of not less than one (1) week, in the proper methods of cleaning and maintaining the work.
外幕墙承包商于验收后，应指导将负责洗窗工作的业主人员或业主指定的物业管理人员，正确的清洗维护方法，指导时间不得少于1星期。

←End of Specification→
最后一页

ATTACHMENT A **WIND TUNNEL TEST RESULT**
附录A **风洞试验结果**

报告书 REPORT

苏州中南中心项目
SUZHOU ZHONGNAN CENTER
中国苏州 SUZHOU, CHINA

幕墙风荷载实验研究 CLADDING WIND LOAD STUDY
RWDI #1904462
March 21, 2020

接收人 SUBMITTED TO

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1 引言 INTRODUCTION

Rowan Williams Davies & Irwin Inc.（RWDI）工程顾问公司受 Gensler Shanghai 委托，对中国苏州的苏州中南中心项目的幕墙风荷载进行了风洞试验研究。本项目包括一栋 500 米高的塔楼。报告书中提供了研究目的，背景资料，研究方法，并且对评估结果进行了讨论。以下表格给出了评估的总体建议。

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Gensler Shanghai to conduct a cladding wind load assessment for the proposed Suzhou Zhongnan Center development in Suzhou, China. The development consists of a 500 m tall tower. This report presents the project objectives, background, approach, and provides a discussion of the results from RWDI's assessment. A summary of the overall recommendations from the assessment is presented in the following table.

项目介绍 Project Details:		
	结构工程师 Structural Engineer	Thornton Tomasetti
	建筑师 Architect	Gensler
主要结果与建议 Key Results and Recommendations:		
	建议的幕墙设计风荷载 Recommended Cladding Design Wind Loads 负风压 Negative Pressures 正风压 Positive Pressures	 图 4a 至 8 Figures 4a to 8 图 9a 至 13 Figures 9a to 13
	负风压范围 Range of Negative Pressures 正风压范围 Range of Positive Pressures	-2.0 kPa to -3.5 kPa +1.5 kPa to +2.5 kPa
基本参数 Selected Analysis Parameters:		
	内压力 Internal Pressures	±0.31 kPa
	中国建筑结构荷载规范 GB 50009-2012 中 50 年的基本风压 50-Year Basic Wind Pressure as per GB 50009-2012	50 年重现期的 10 米高度 10 分钟平均风压为 0.45 kN/m^2 0.45 KN/m^2 (26.8 m/s) 10-minute mean at 10 m in open terrain
	重要性系数 Importance Factor on Wind Pressure	1.0

本研究所采用的风洞测试技术满足或超过中国建筑结构荷载规范 GB50009-2012 以及美国 ASCE7-05 标准中第 6.6 节之要求，以下各章节将分别介绍所采用的试验方法并讨论试验结果与建议，附录 A 给出有关这类研究的试验与分析方法的背景资料。

The wind tunnel test procedures met or exceeded the requirements set out in Section 31.2 of the ASCE 7-10 Standard and the Load Code for the Design of Building Structures GB 50009-2012 for China. The following sections outline the test methodology for the current study, and discuss the results and recommendations. Appendix A provides additional background information on the testing and analysis procedures for this type of study.

2 风洞试验 WIND TUNNEL TESTS

2.1 试验模型与场地模型 Study Model and Surroundings

根据附录 B 所列建筑图纸，RWDI 制作了 1:500 缩尺的大楼模型，模型试验在 RWDI 位于安大略省圭尔夫市的边界层风洞中进行，模型试验中包括大楼周围近 610 米半径范围内所有建筑地貌。试验包括两个环境工况下：

工况 1 — 拟建中南中心项目 + 现有周边环境；

工况 2 — 拟建中南中心项目 + 现有周边环境 + 未来建筑；

A 1:500 scale model of the proposed development was constructed using the architectural drawings listed in Appendix B. The model was instrumented with pressure taps and was tested in the presence of all surroundings within a full-scale radius of approximately 610m, in RWDI's boundary layer wind tunnel facility in Guelph, Ontario for the following test configurations:

configuration 1 - Proposed Suzhou Zhongnan Center development with existing surrounding

configuration 2 - Proposed Suzhou Zhongnan Center development with existing surrounding and the future development.

本报告中所述的幕墙风荷载是将两个环境工况下的实验数据合并为一组幕墙设计风荷载的结果。

The cladding wind loads represented in this report are a result of combining the data from the two test configurations into one consolidated set of cladding design wind loads.

边界层风洞中缩尺模型的照片如图 1a 和 1b 所示，分别对应于工况 1 和 2。图 2 给出了显示研究地点的定位图。

Photographs of the wind tunnel study model are shown in Figure 1a and 1b corresponding to test configuration 1 and 2 respectively. An orientation plan showing the location of the study site is given in Figure 2.

2.2 风剖面 Upwind Profiles

对场地模型以外的大气边界层上风向地貌影响是通过在风洞工作段前方设置适当的地面粗糙元与紊流尖塔对每个风向逐一模拟。这一风洞模拟以及随后的模型数据分析旨在反映了下列上风向地貌情况。其中风向定义为风的来流方向，以正北方向为零度顺时针计算。

Beyond the modelled area, the influence of the upwind terrain on the planetary boundary layer was simulated in the testing by appropriate roughness on the wind tunnel floor and flow conditioning spires at the upwind end of the working section for each wind direction. This simulation, and subsequent analysis of the data from the model, was targeted to represent the following upwind terrain conditions. Wind direction is defined as the direction from which the wind blows, measured clockwise from true north.

上风向地貌 Upwind Terrain	风向 Wind Directions (Inclusive)
市郊/开阔地貌(近 B 类)—紧邻场地模型的上风向地貌为高低交错的建筑，近场为水域 Open Suburban - terrain with a combination of low-rise and high-rise buildings, farmland, and water in the near field	10° to 60°, 70° to 170°, 200° to 240°, 350°,360°

市郊地貌 （近 C 类）—紧邻场地模型的上风向地貌为高低交错的建筑，农田，远处为水域 Suburban - terrain with a combination of low-rise and high-rise buildings, farmland, and water in the far field	180° to 190°, 250° to 340°

3 风气候 WIND CLIMATE

为了预计在不同重现期下作用在实际建筑物上的结构风荷载，风洞实验结果需结合当地的风气候统计模型。本项目中所用风气候统计模型是根据上海气象局的近地风记录以及台风的计算机模拟的苏州台风得到的。台风模拟结果是由美国的应用研究所（ARA）采用蒙特卡罗模拟方法提供的。模拟了超过十万年的热带风暴以考察台风风速随风向的变化。

In order to predict the full-scale wind pressures acting on the building as a function of return period, the wind tunnel data were combined with a statistical model of the local wind climate. The wind climate model was based on local surface wind measurements taken at Shanghai Met Station with Suzhou Typhoon Simulation. The typhoon simulation was provided by Applied Research Associates, Raleigh, NC using the Monte Carlo Technique. Over 100,000 years of tropical storms were simulated to account for the variability of typhoon wind speed with direction.

图 3 所示为台风和外热带（即非台风）风气候强度和风向的对比。这些图仅供说明使用而不能直接用于预计风致响应。上方两张图说明了普通风（左图）和极端风（右图）的风向，由于台风是极端情况，因此仅在右图中包括台风。可以看出在极端情况下，西北风最大，东南偏东风次之。下方的图显示风速作为重现期函数的数据集。

Figure 3 shows a comparison of strength and directionality of typhoon and extra-tropical (i.e., non-typhoon) wind climates for Suzhou. These plots are illustrative only and are not to be used directly for predictions of wind loads. The upper two plots show the directionality of common winds on the left and extreme winds on the right. Since typhoons are extreme events, they are only included on the right plot. It can be seen that for the extreme events, the winds from the northwest are the strongest, with a secondary lobe for winds from the east-southeast. The lower plot shows the wind speeds from each data set as a function of return period.

中国建筑结构荷载规范 GB50009-2012 规定的苏州 50 年重现期下 10m 高度开阔场地的 10 分钟平均风压分别为 0.45 kPa，此风压等同于开阔场地下 10m 高度 10 分钟平均风速为 26.8 m/s。图 3 也显示了该风速。对于强度设计时的风荷载预计，对风气候模型进行了修正以符合 GB50009-2012 规定的 50 年重现期风压的设计风速。

The 50-year basic wind pressure for Suzhou, specified in the GB 50009-2012 is 0.45 kPa (10-minure mean) at a height of 10 m in open terrain. This wind pressure corresponds to a 10-minute mean wind speed of 26.8 m/s, which is also shown in Figure 3. For the wind loading predictions in this report, the wind climate model was scaled to match the design wind speed at the 50-year return period.

4 由风洞试验结果确定幕墙风荷载 DETERMINING CLADDING WIND LOADS FROM WIND TUNNEL TEST RESULTS

幕墙单元设计中必须考虑的净风荷载包括作用在幕墙外表面的风荷载与作用在内表面的荷载。本报告书给出的净风压中的外表面风压由风洞试验模型上直接量测得到，而内表面的风压则由结合风洞试验结果的分析方法求出。

For design of cladding elements, the net wind load acting across an element must be considered. The results provided in this report include the contributions of the wind loads acting on both the external surface (measured directly on the scale model during the wind tunnel test) and internal surface of the element (determined through analytical methods and the wind tunnel test data).

对只有外墙面暴露于风场的幕墙单元，其设计净风压必须通过在测试所得的外压上叠加适当的内压后求出。在强风情况下，幕墙的内压主要由气流泄漏效应造成。而引起大楼内气流泄漏的主要来源包括均匀分布在建筑表面较小的气流泄漏通道和较大的泄漏路径，这些较大的泄漏路径包括风暴中产生的碎片引起的窗户破裂或开启式的门窗处于开启情形。

For elements exposed to wind on the external surface only, an internal pressure allowance must be applied to the measured external pressure in order to determine the net pressure applicable for design. In strong winds, the internal pressures are dominated by air leakage effects. Important sources of air leakage include uniformly distributed small leakage paths over the building's envelope and larger leakage paths. These larger leakage paths include window breakage due to airborne debris in a windstorm and open doors or windows, in cases where they are operable.

本报告所提供的风荷载是差压，包括基于没有任何大开口或明显开口的建筑物的风致容许内压值。主要幕墙，屋面和拱腹面容许内压值为±0.31 kPa。

The wind loads provided are differential pressures that include an allowance for wind-induced internal pressure based on a building without any large or significant openings. The resulting internal pressure allowance values for main façade, roofs and soffits were ±0.31 kPa.

大楼幕墙上的峰值负压是通过将负外压迭加适当的正内压得到的。类似地，大楼幕墙上的峰值正压是将正外压迭加适当的负内压得到的。

To obtain the net peak negative pressure on the building's cladding, the negative exterior pressures were augmented by an amount equal to the positive internal pressure. Likewise, the net peak positive pressures were obtained by augmenting the exterior positive pressure by an amount equal to the magnitude of the negative internal pressure.

对于两面均暴露于风下的构件，如女儿墙，其净风压是通过测量通过构件瞬时压差确定的。

For elements exposed to wind on opposite surfaces such as parapets, the net pressure acting on the element was determined by measuring the instantaneous pressure difference across the element.

5 建议的幕墙设计风荷载 RECOMMENDED CLADDING DESIGN WIND LOADS

对 50 年重现期的外幕墙设计，建议采用图 4a 至图 13 给出的风压。图中的等风压区以-0.5kPa 分级，所标示的压力为该等压区内最大风压。例如-2.0 kPa 等压区内的实际风压为-1.51 kPa 至-2.0 kPa。

It is recommended that the wind loads presented in Figures 4a through 13 be considered for the 50-year return period. The drawings in these figures have generally been zoned using -0.50 kPa so that the pressure indicated is the maximum pressure in that particular zone. For example, a -2.0 kPa zone would have pressures ranging from -1.51 kPa to -2.0 kPa.

请注意所建议的设计压力是用于外幕墙抗风压设计，其数值中已包括内压。但按该建议风压设计的幕墙不一定能完全防止由于飞掷物造成的窗户破碎。

Note that the recommended wind loads are for cladding design for resistance against wind pressure, including an allowance for internal pressures. Design of the cladding to the provided wind loads will not necessarily prevent breakage due to impact by wind borne debris.

请注意本报告书给出的风荷载中已考虑了当地的风向影响，但不包括安全系数或荷载系数。可将本报告书中给出的风荷载等同于由规范计算所得风荷载，并将其具体应用于大楼的幕墙设计。

Note that the wind loads provided in this report include the effects of the directionality in the local wind climate. These loads do not contain safety or load factors and are to be applied to the building's cladding system in the same manner as would wind loads calculated by code analytical methods.

“负压力”或吸力定义为垂直指离墙面的压力，而“正压力”则为垂直指向墙面的压力。

"Negative pressure" or suction is defined to act outward normal to the building's exterior surface and "positive pressure" acts inward.

建议最大幕墙负风压为 -3.5 kPa，该最大负风压出现于大楼的北立面和西立面（分别如图 4b 和 5a 所示）。建议最大外幕墙正风压为 +2.5 kPa，该最大正风压出现于大楼的北立面（如图 9c 所示）。

The largest recommended negative cladding wind load was -3.5 kPa, which occurred on the North and West Elevation (Figures 4b and 5a). The largest recommended positive cladding wind pressure was +2.5 kPa, which occurred on North Elevation (Figure 9c).

6 结果的适用性 APPLICABILITY OF RESULTS

6.1 周边场地模型 The Proximity Model

由风洞试验及前述相关分析得到的幕墙设计风荷载是根据特定的周边场地情况得出的。风洞试验中考虑的周边场地情况包括目前的现场状况。今后如果在周边区域建造更多的建筑物或拆除近场的某些建筑物，则有可能影响作用在大楼上的风力。为了对未来的场地变化影响有一定的考虑，我们最后建议塔楼的幕墙设计风压不小于 ±1.5 kPa，屋面区域

的设计风压正压不小于+1.0 kPa。**注意：此报告提供的幕墙设计风荷载是建立在所有水平屋面均非玻璃的理解上的。如果这不是实际工况，RWDI 应当被告知。**

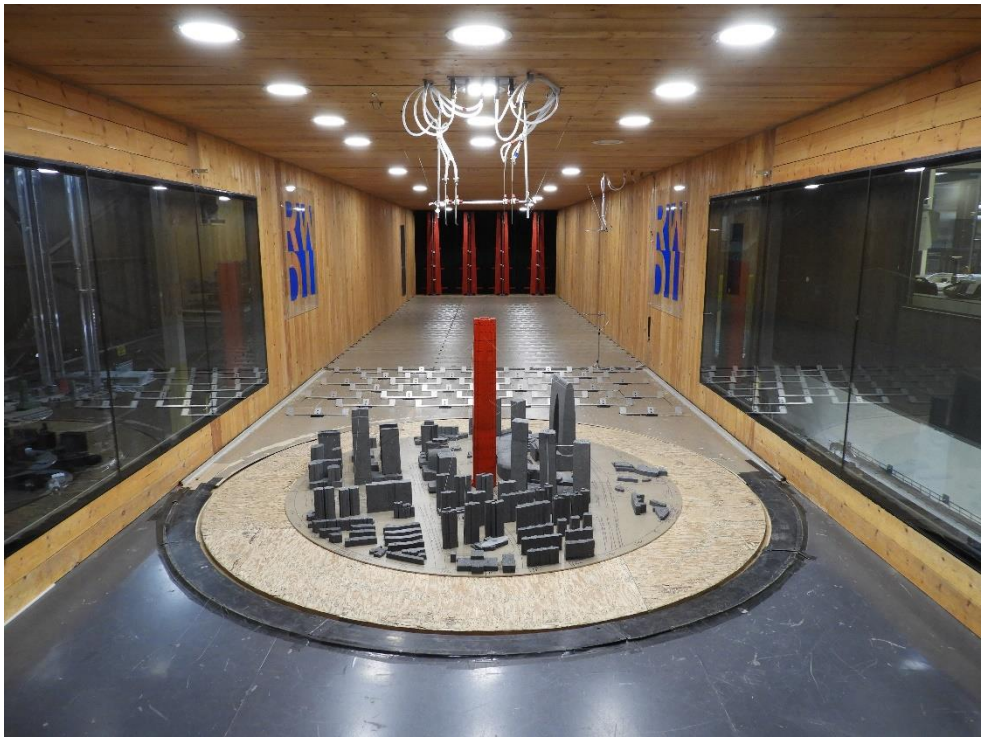
The cladding design wind loads determined by the wind tunnel tests and aforementioned analytical procedures are applicable to the particular configuration of surroundings modeled. The surroundings model used for the wind tunnel tests reflected the current state of development at the time of testing. If, at a later date, additional buildings besides those considered in the tested configuration are constructed or demolished near the project site, then some load changes could occur. To make some allowance for possible future changes in surroundings, our final recommended cladding design wind loads do not go below a minimum of ±1.5 kPa, with the exception of +1.0 kPa minimum on roof areas. **Note that the cladding design wind loads provided in this report are given with the understanding that all horizontal roof surfaces are non-glazed. If this is not the case then RWDI should be contacted.**

6.2 试验模型 Study Model

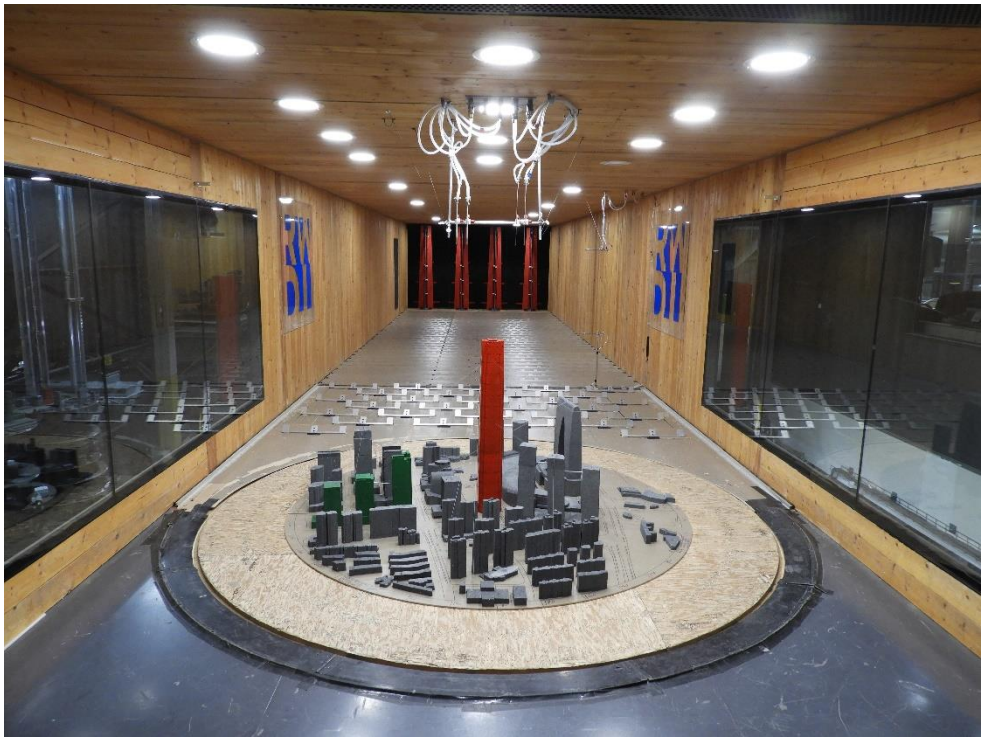
本报告书提供的结果是根据按附录 B 所列建筑资料制作的大楼模型。如果日后对建筑设计进行修改，导致与上述资料有较大的不一致，则相应的风致结构响应可能与本报告书中的结果有一定出入。因此若有设计修改，应通知 RWDI，并提出设计审阅的要求，以确定这些修改对风荷载的影响。

The results presented in this report pertain to the scale model of the proposed development, constructed using the architectural information listed in Appendix B. Should there be any design changes that deviate substantially from the above information, the results for the revised design may differ from those presented in this report. Therefore, if the design changes, RWDI should be contacted and requested to review the impact on the wind loads.

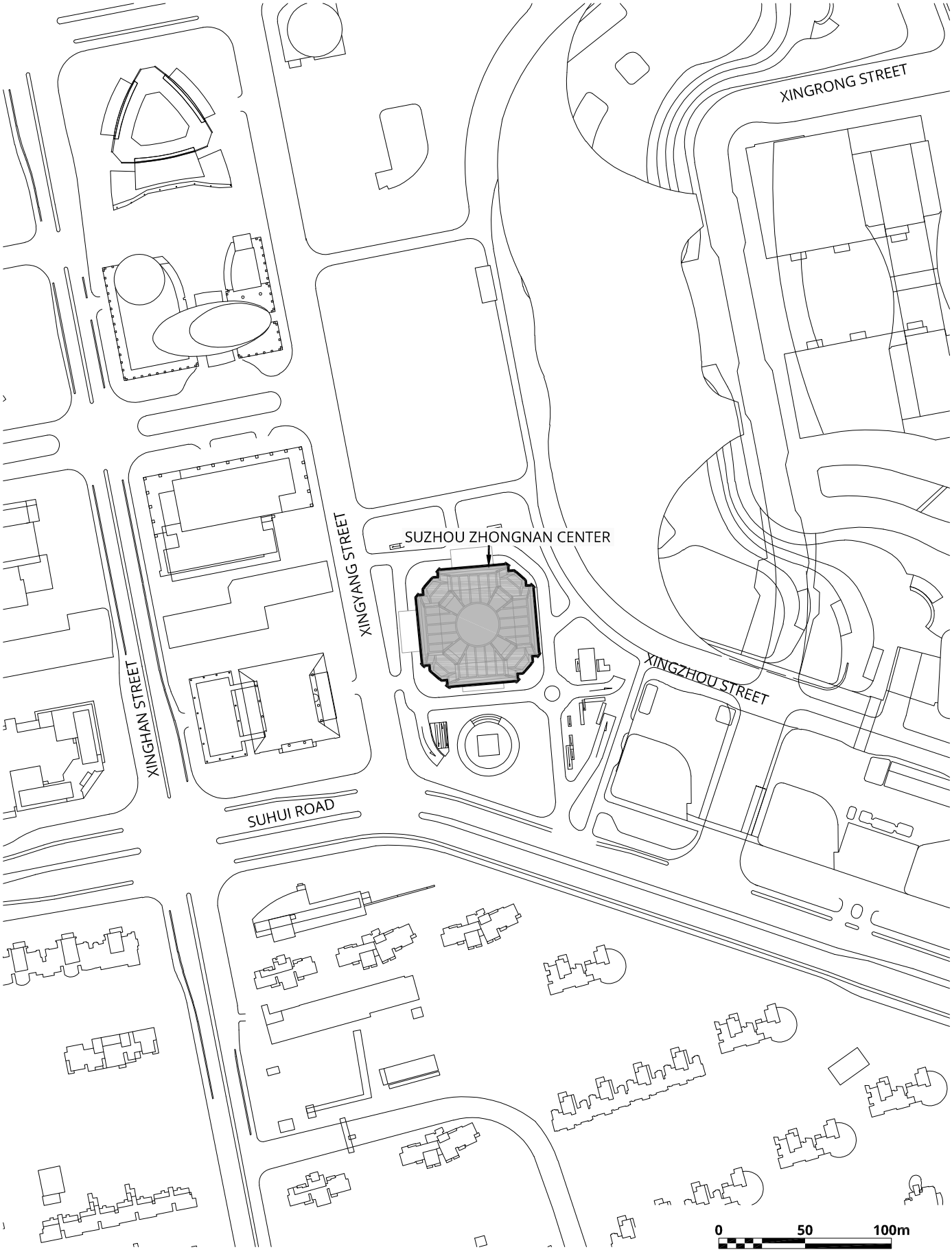
FIGURES



Wind Tunnel Study Model Configuration - 1	Figure: 1a	
Suzhou Zhongnan Center – Suzhou, China Project #1904462	Date: Mar. 20, 2020	



Wind Tunnel Study Model Configuration - 2	Figure: 1b	
Suzhou Zhongnan Center – Suzhou, China Project #1904462	Date: Mar. 20, 2020	



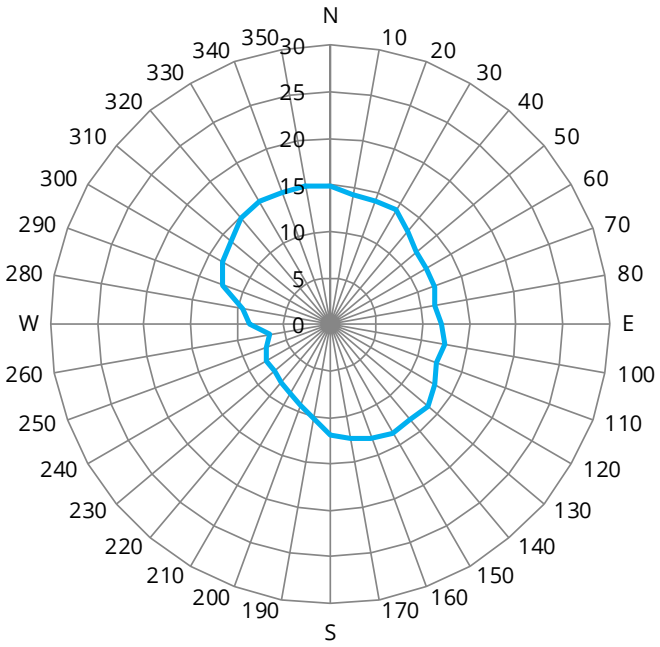
Site Plan

True North

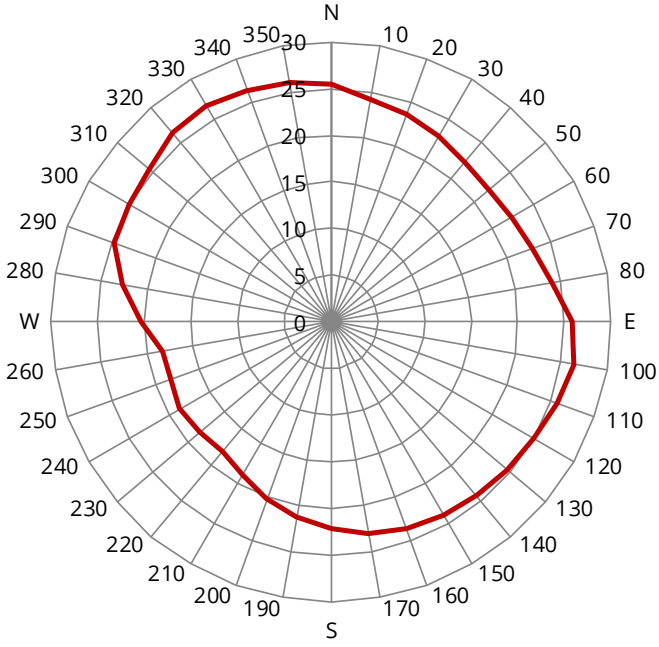
Drawn by: MBR	Figure: 2
Approx. Scale:	1:3000
Date Revised:	Mar. 19, 2020

Suzhou Zhongnan Center - Suzhou, China

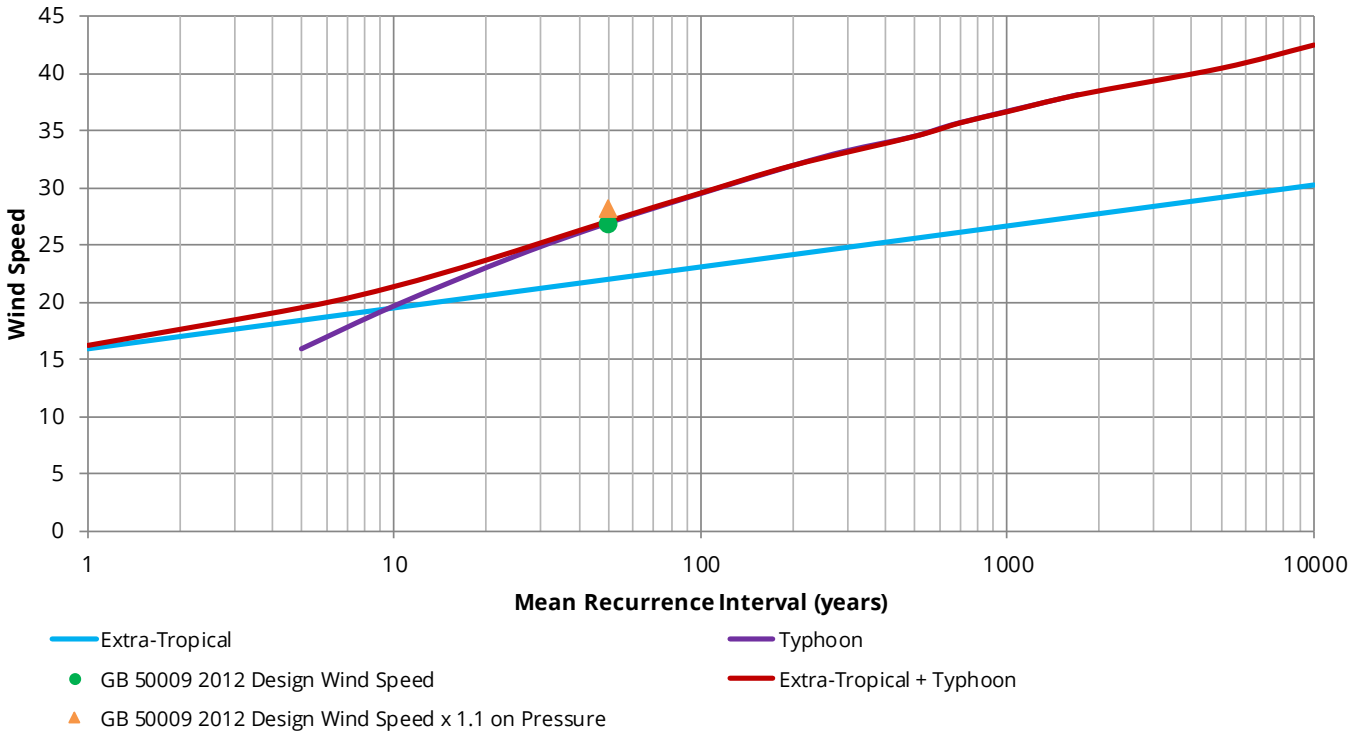
Project #1904462



Common Winds

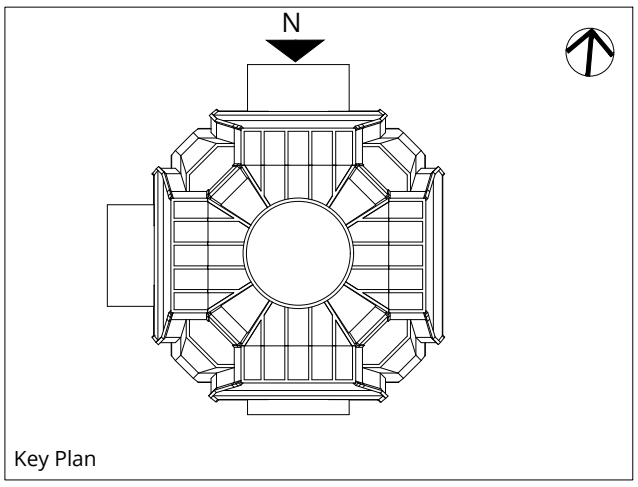


Design Winds



Note: Wind Speeds shown are 10-minute Mean Wind Speeds (m/s) at 10 m height in Open Terrain

Directional Distribution of Local Wind Speeds	Figure: 3	
Suzhou Zhongnan Center – Suzhou, China Project #1904462	Date: Mar. 20, 2020	



Note:
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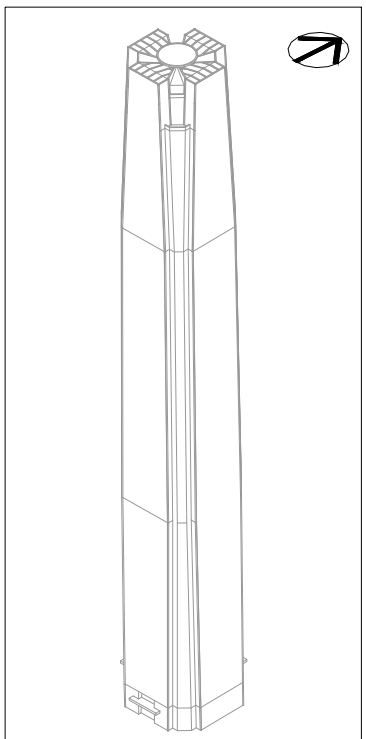
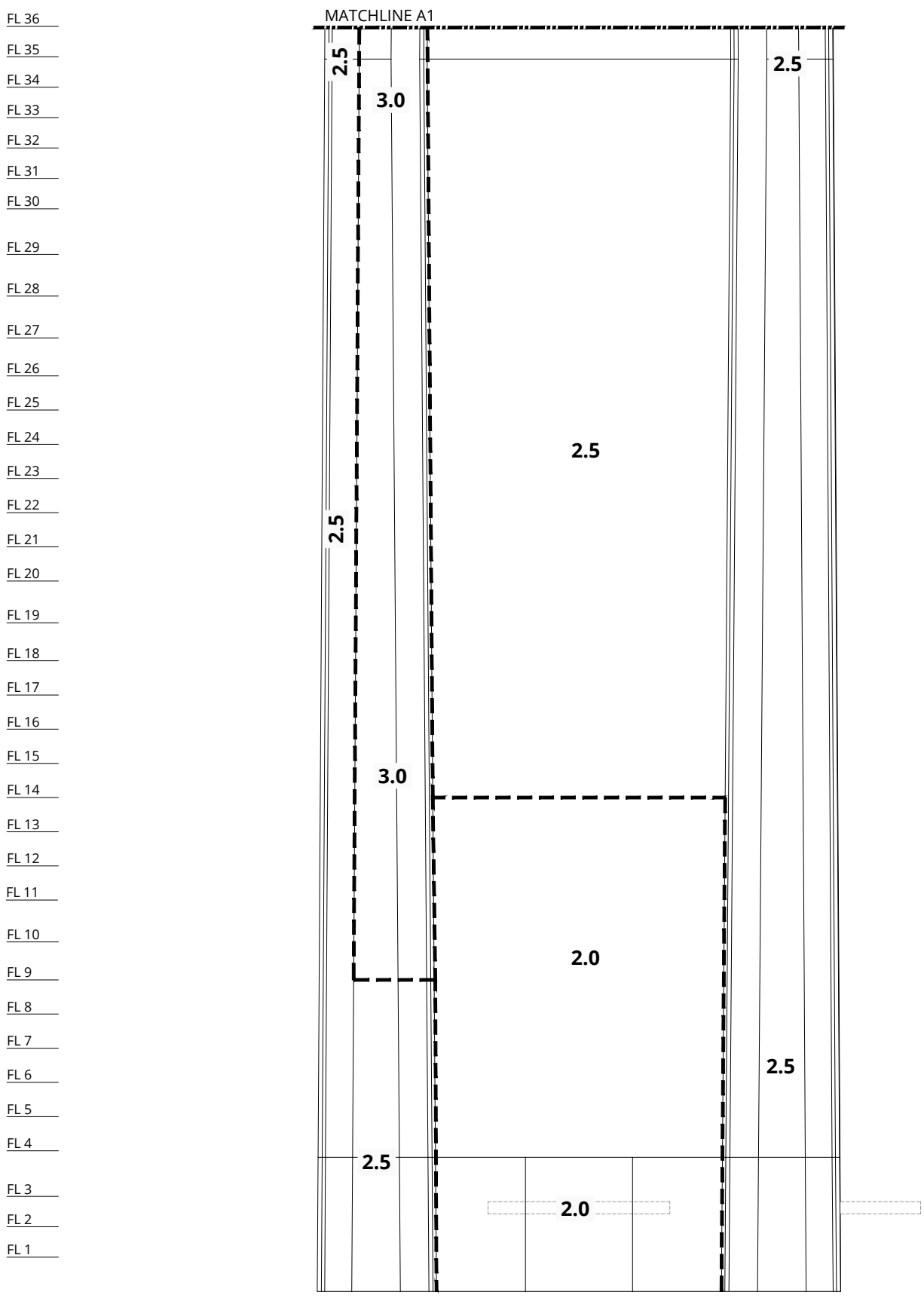

Isometric View of the Building



NORTH ELEVATION

0 10 30m

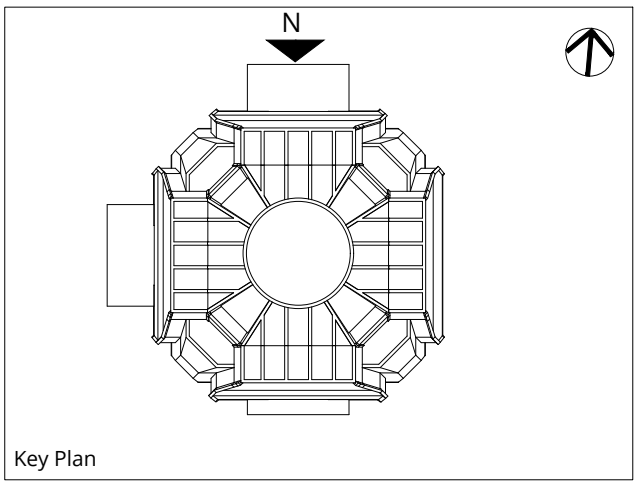
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 4a
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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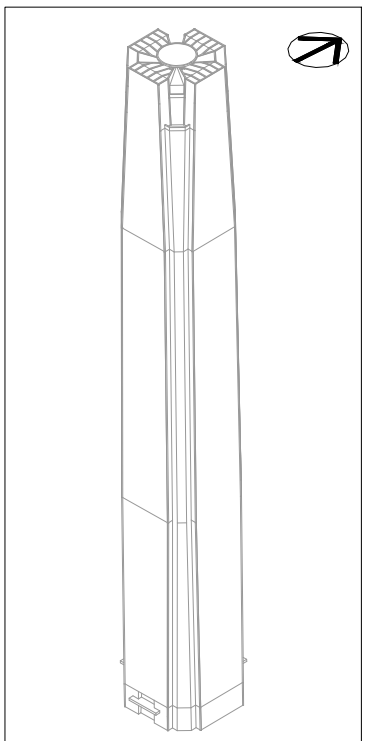
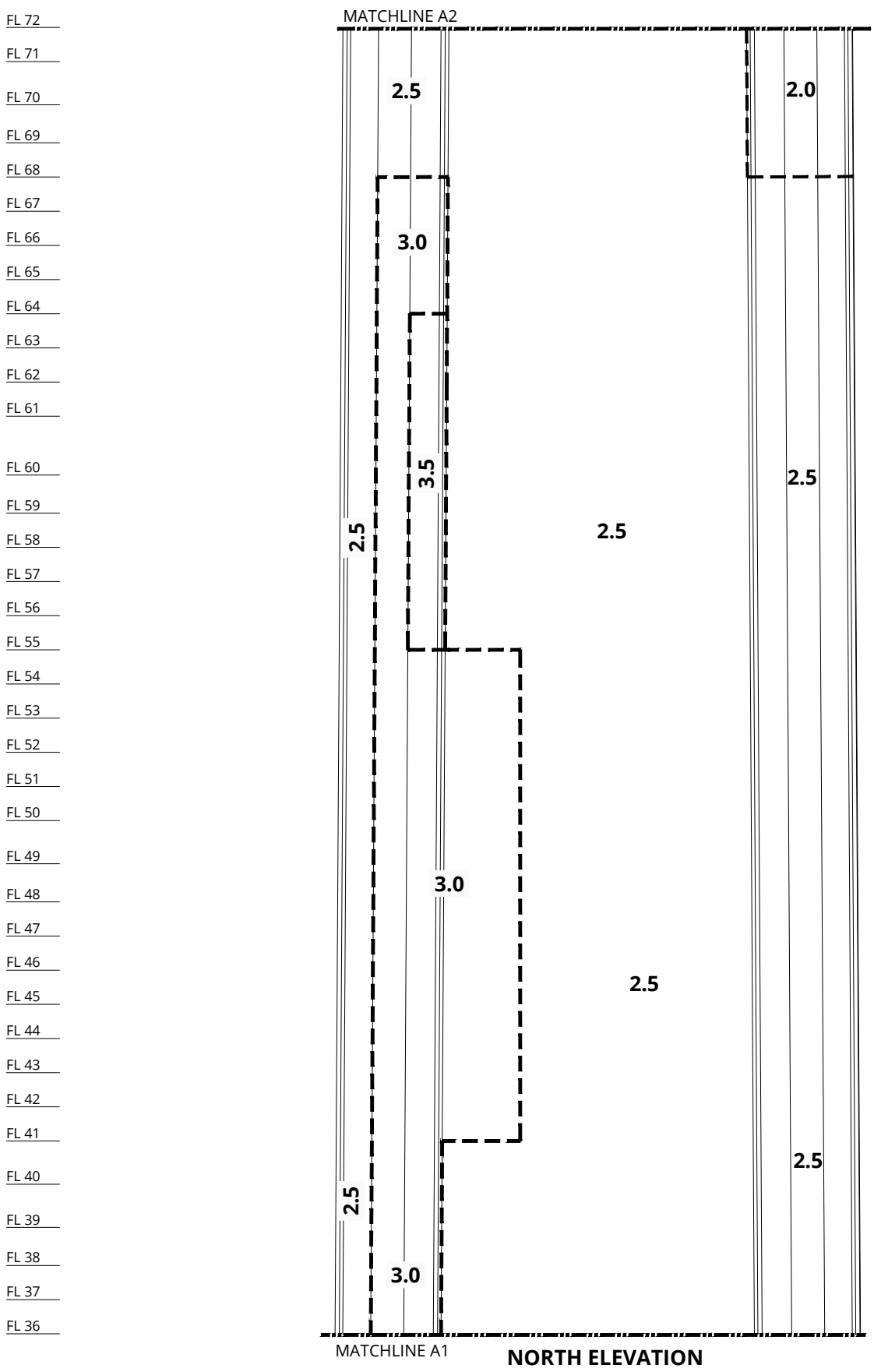


Isometric View of the Building



NORTH ELEVATION

0 10 30m

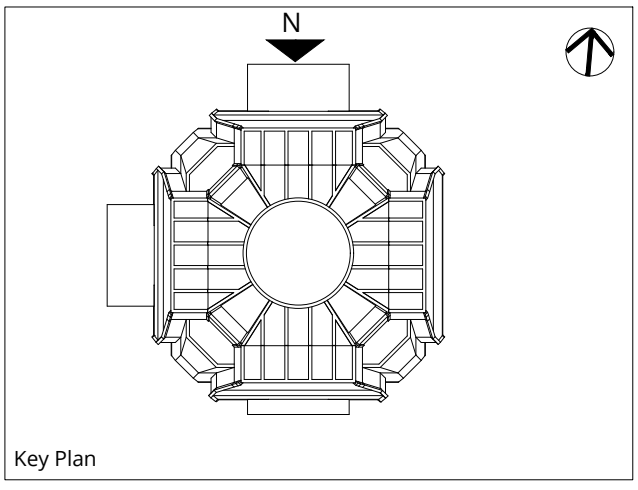
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 4b
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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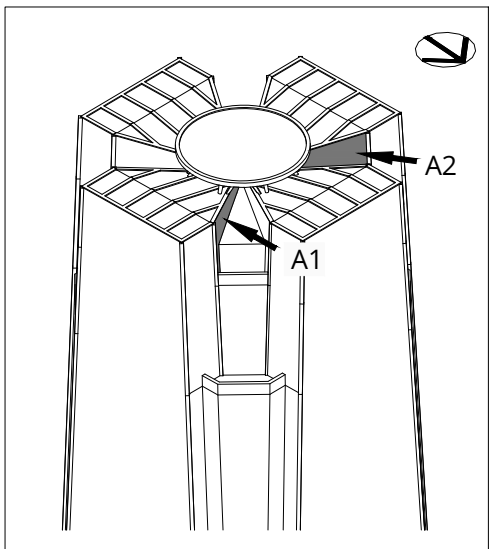
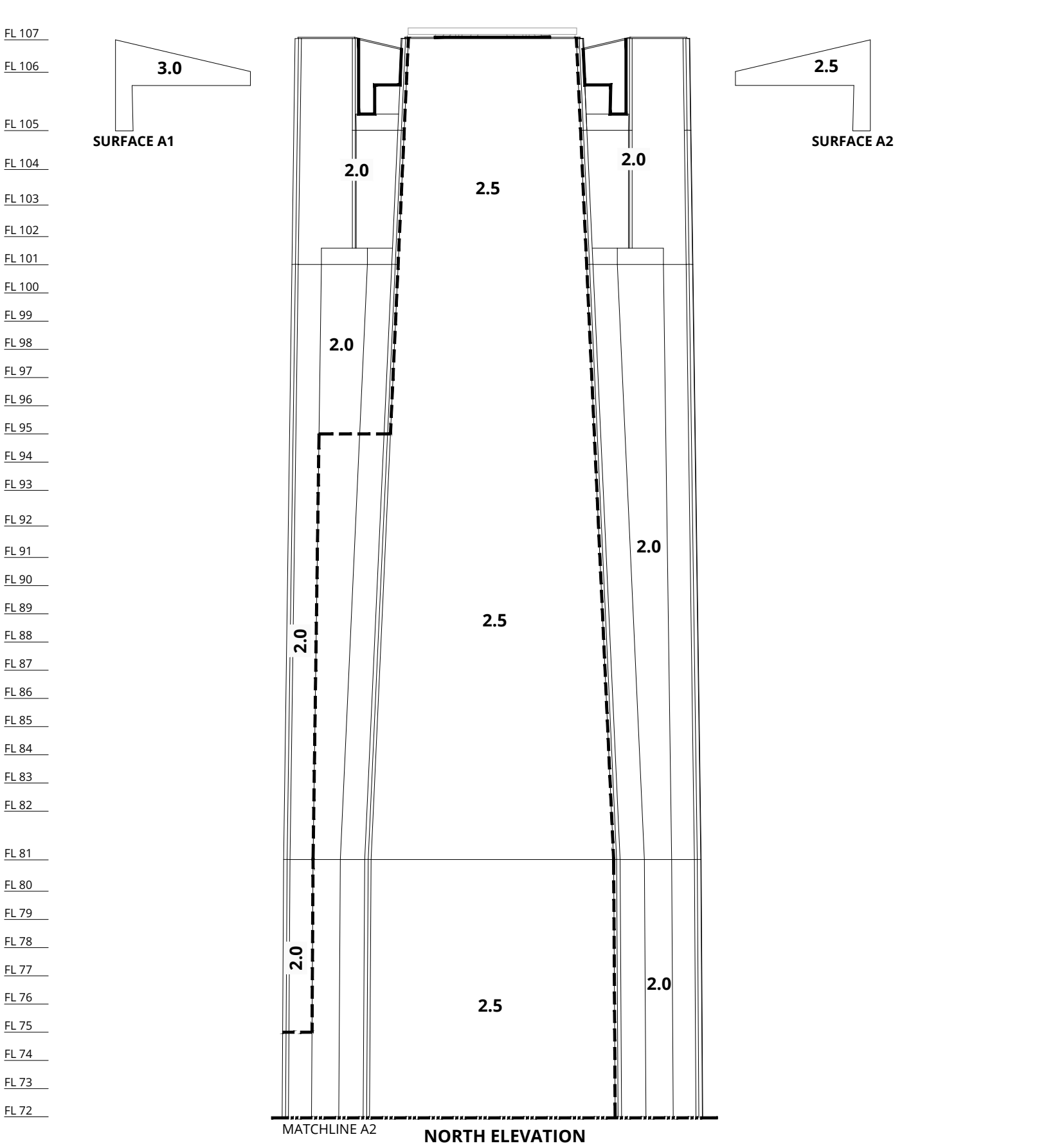


Key Plan of Wall Surfaces (A)



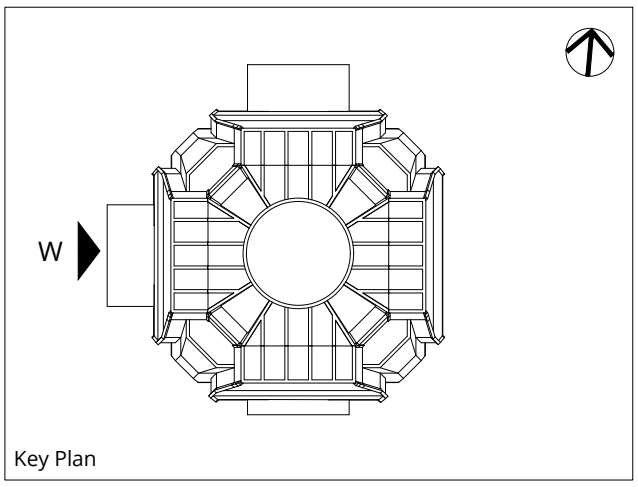
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR | Figure: 4c
Approx. Scale: 1:750
Date Revised: Mar. 16, 2020



Note:
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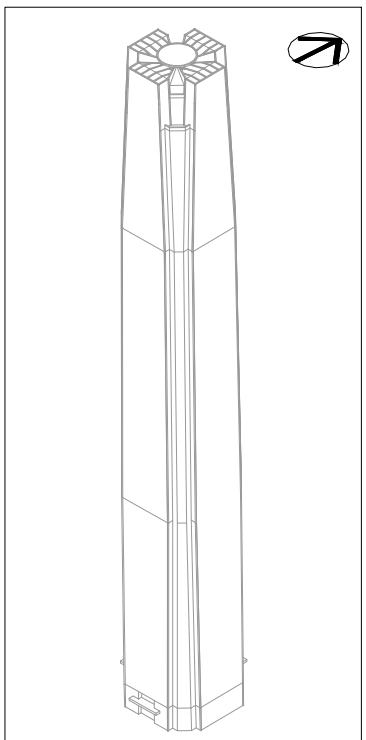
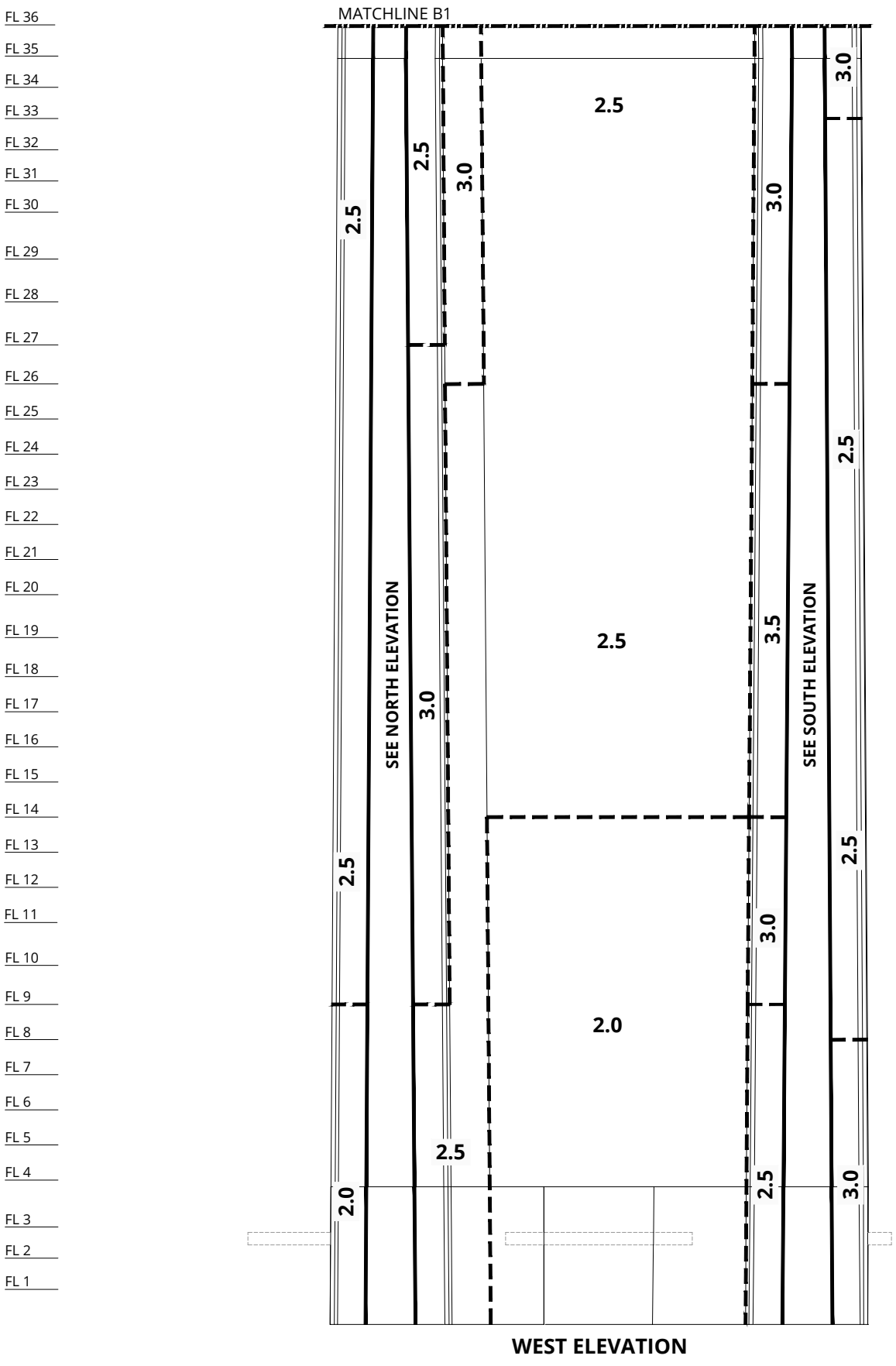

Isometric View of the Building



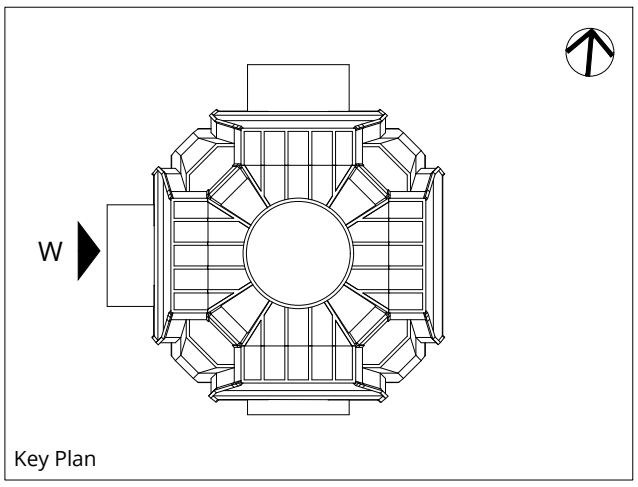
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 5a
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Note:
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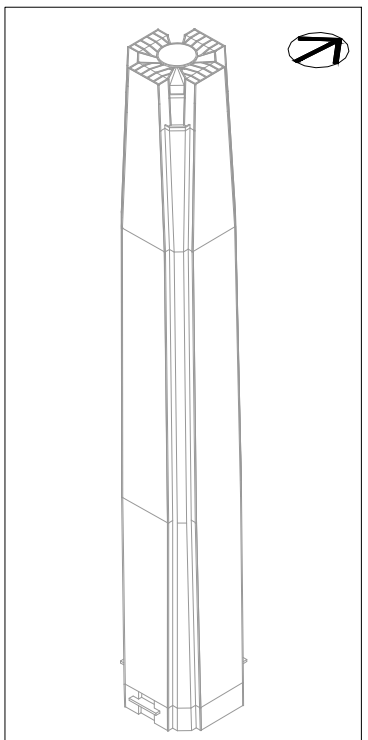
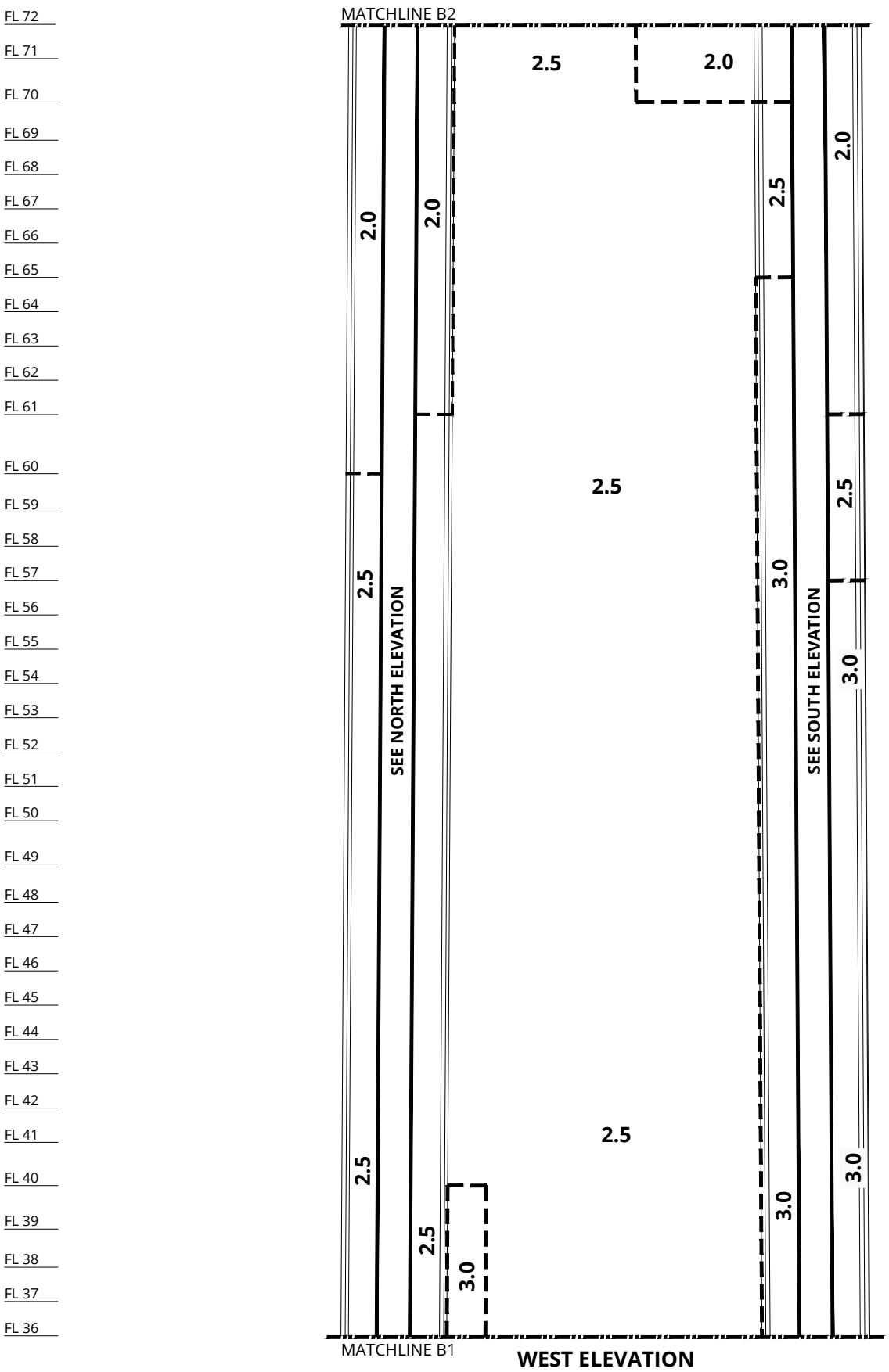

Isometric View of the Building



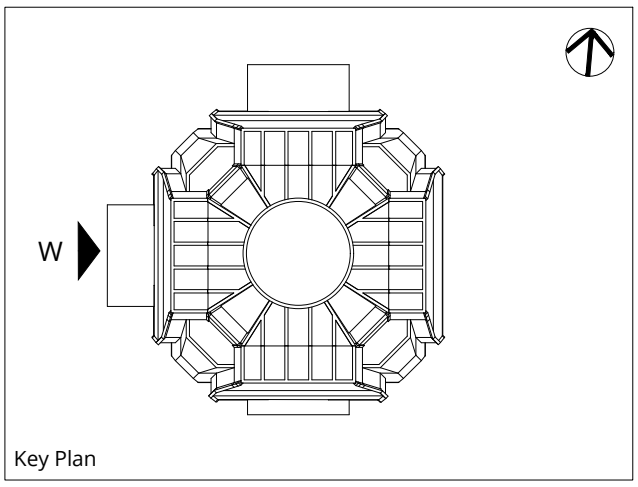
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 5b
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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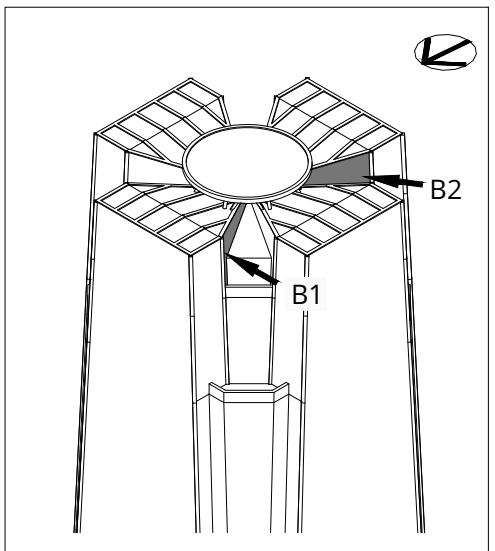
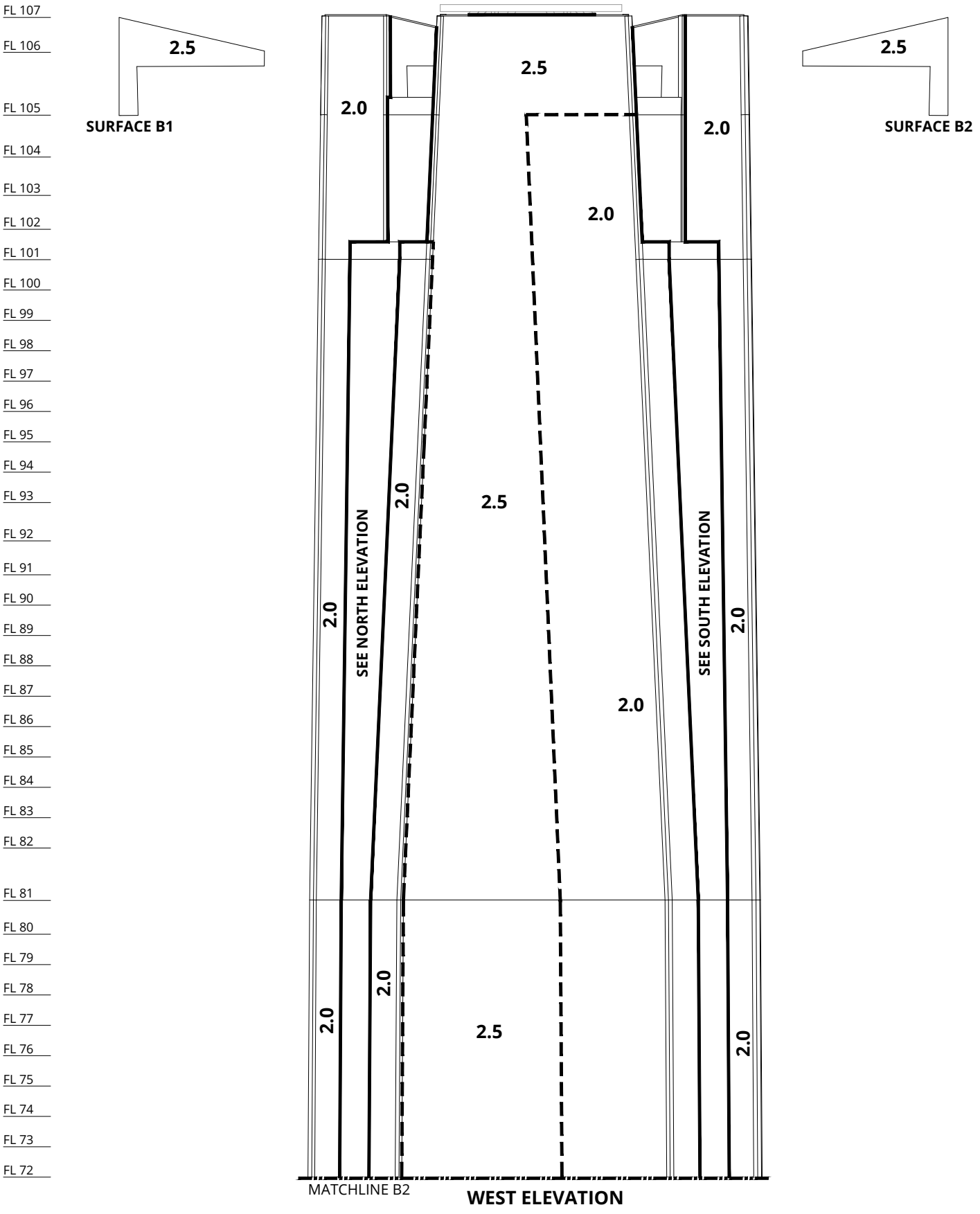


Key Plan of Wall Surfaces (B)



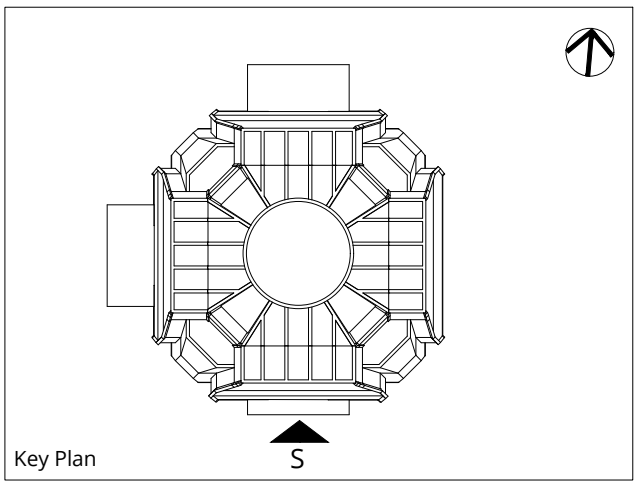
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

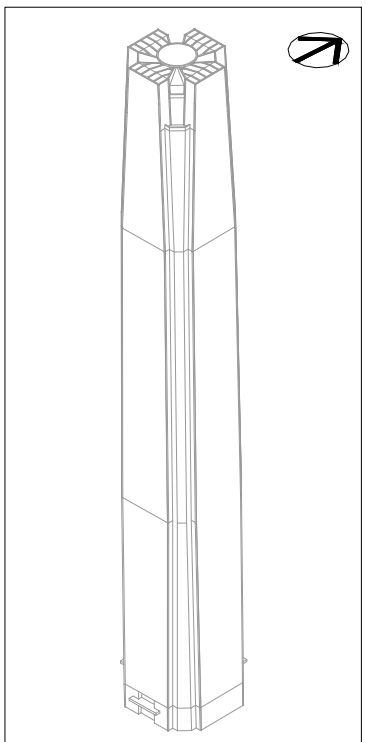
Project #1904462

Drawn by: MBR	Figure: 5c
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020

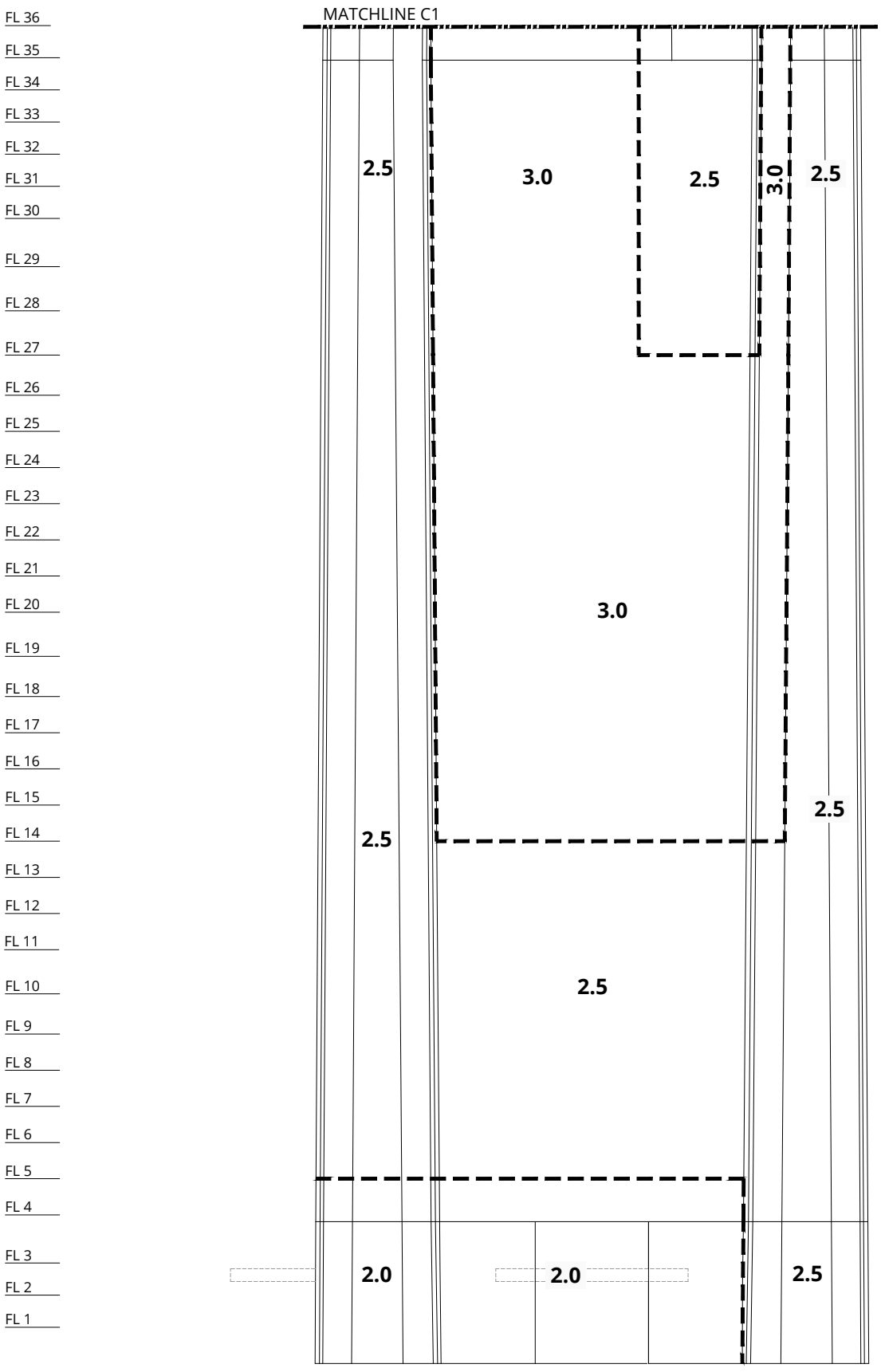


Key Plan

Note:
The wind loads presented ***do not*** contain load or safety factors. The loads are to be applied to the building's cladding system in the same manner as would wind loads calculated by building code analytical methods.



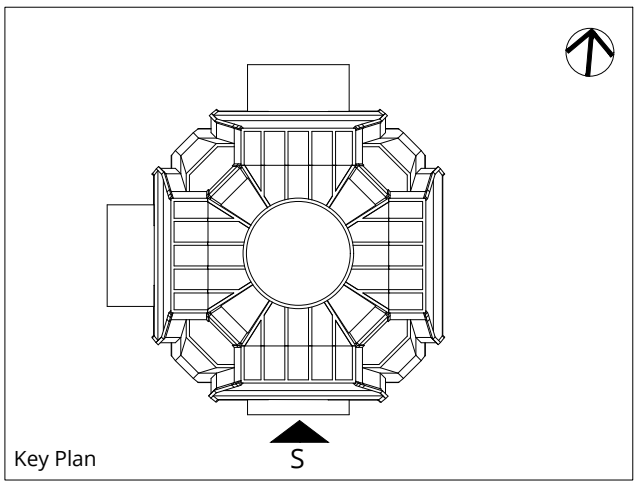
Isometric View of the Building



SOUTH ELEVATION

0 10 30m

Recommended Wind Loads for Cladding Design (kPa) Peak Net Negative Pressures (Negative External Pressure with Positive Internal Pressure Where Applicable) 50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0 Suzhou Zhongnan Center - Suzhou, China	Project #1904462	Drawn by: MBR Figure: 6a Approx. Scale: 1:750 Date Revised: Mar. 16, 2020



Key Plan

Note:
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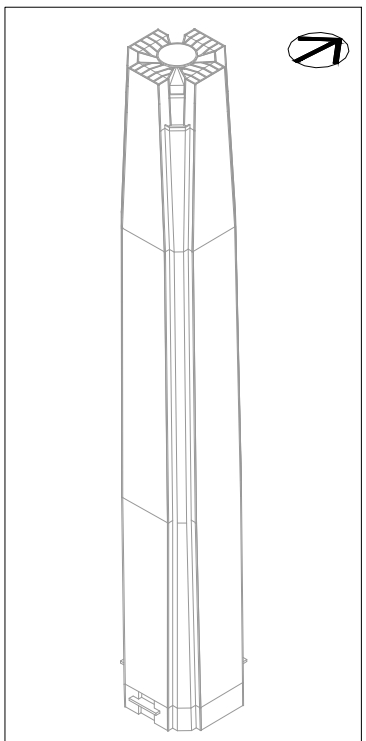
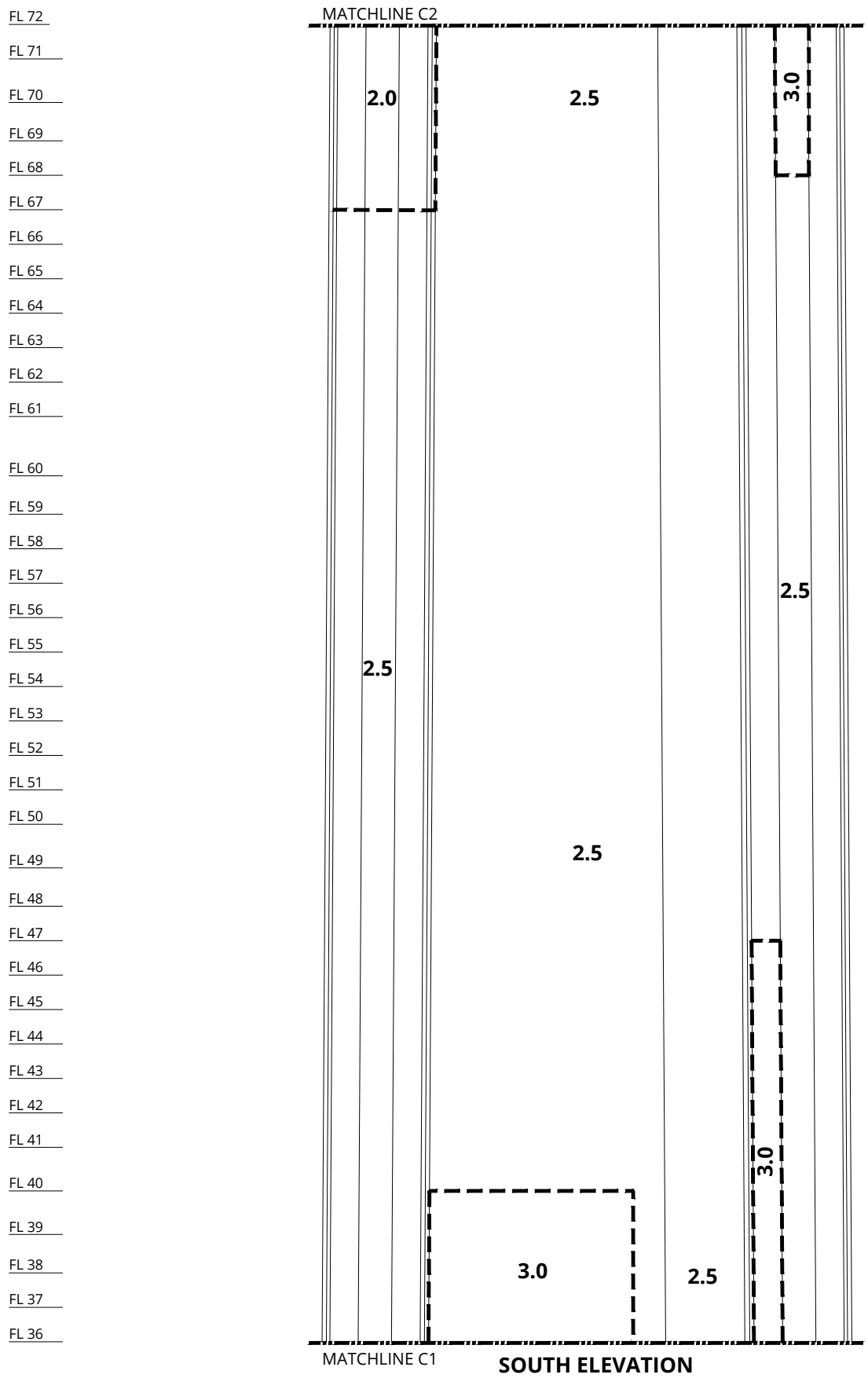


Isometric View of the Building



SOUTH ELEVATION

0 10 30m

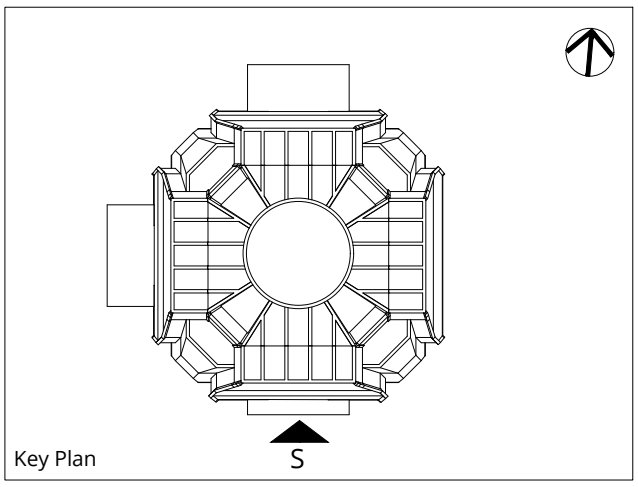
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 6b
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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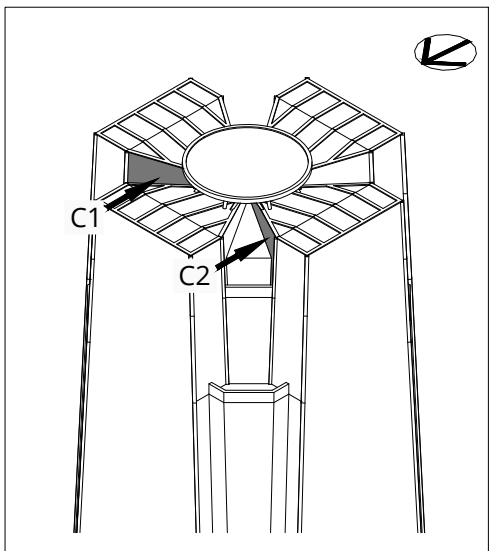
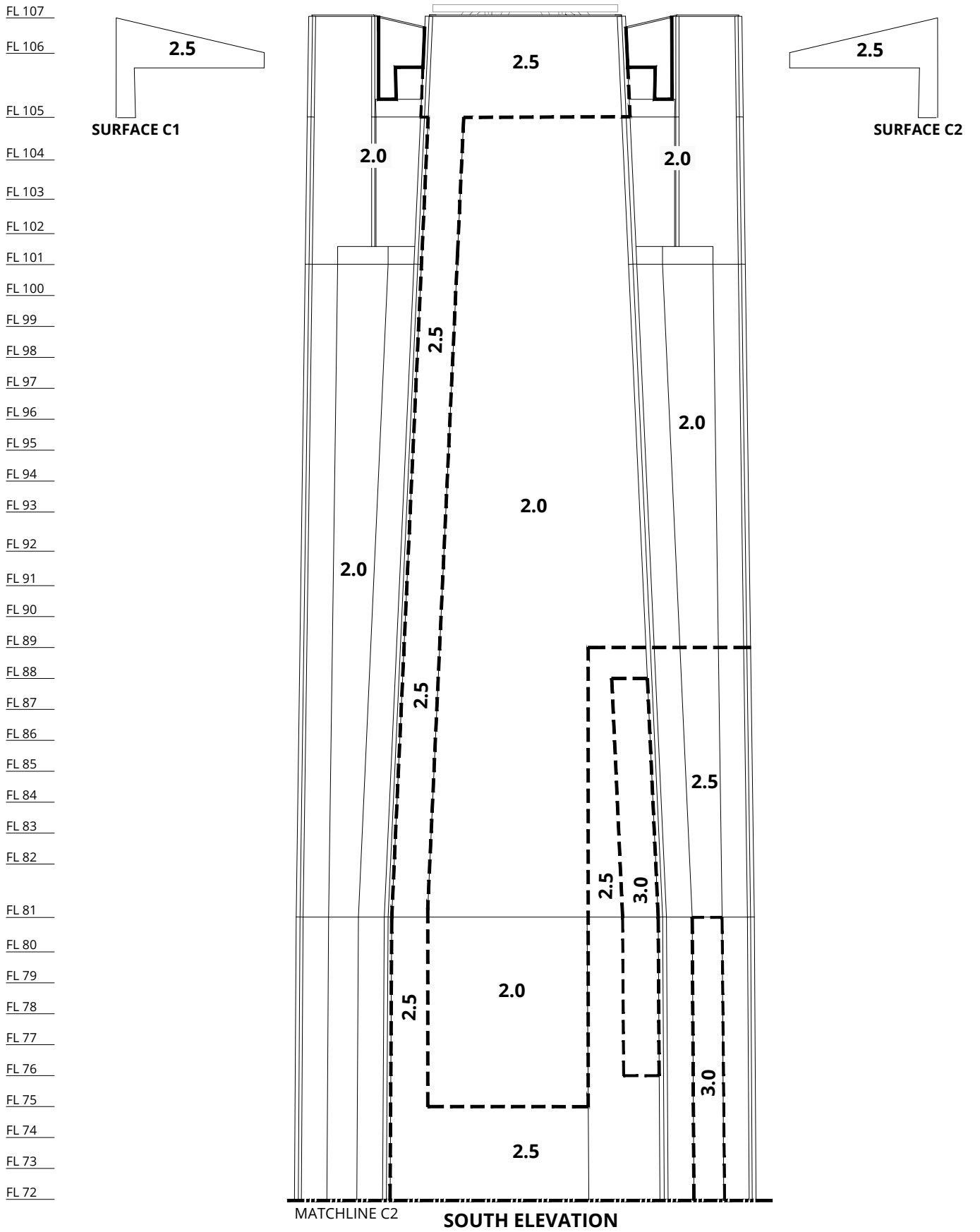


Key Plan of Wall Surfaces (C)



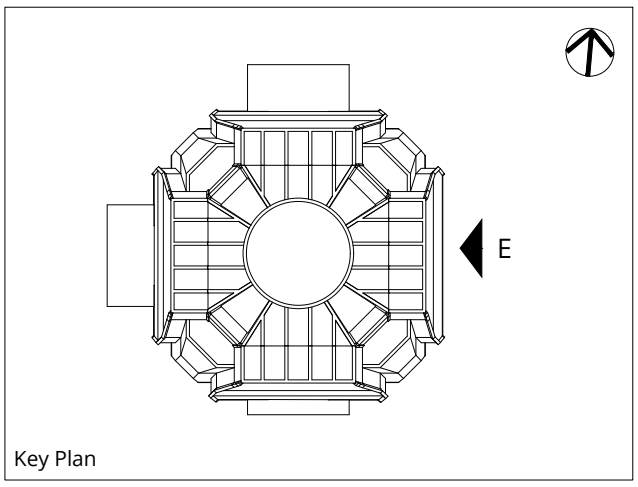
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR | Figure: 6c
Approx. Scale: 1:750
Date Revised: Mar. 16, 2020



Key Plan

Note:
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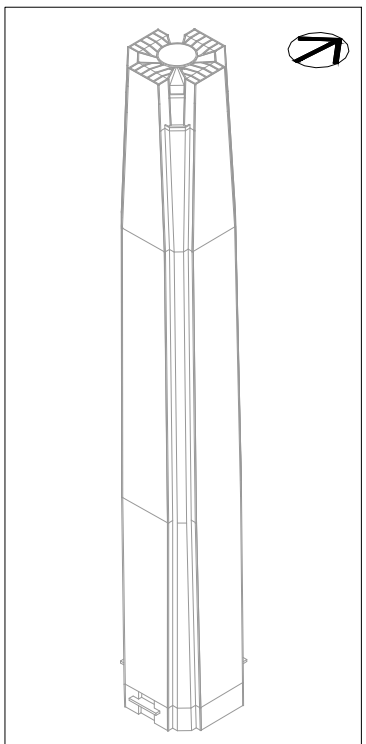
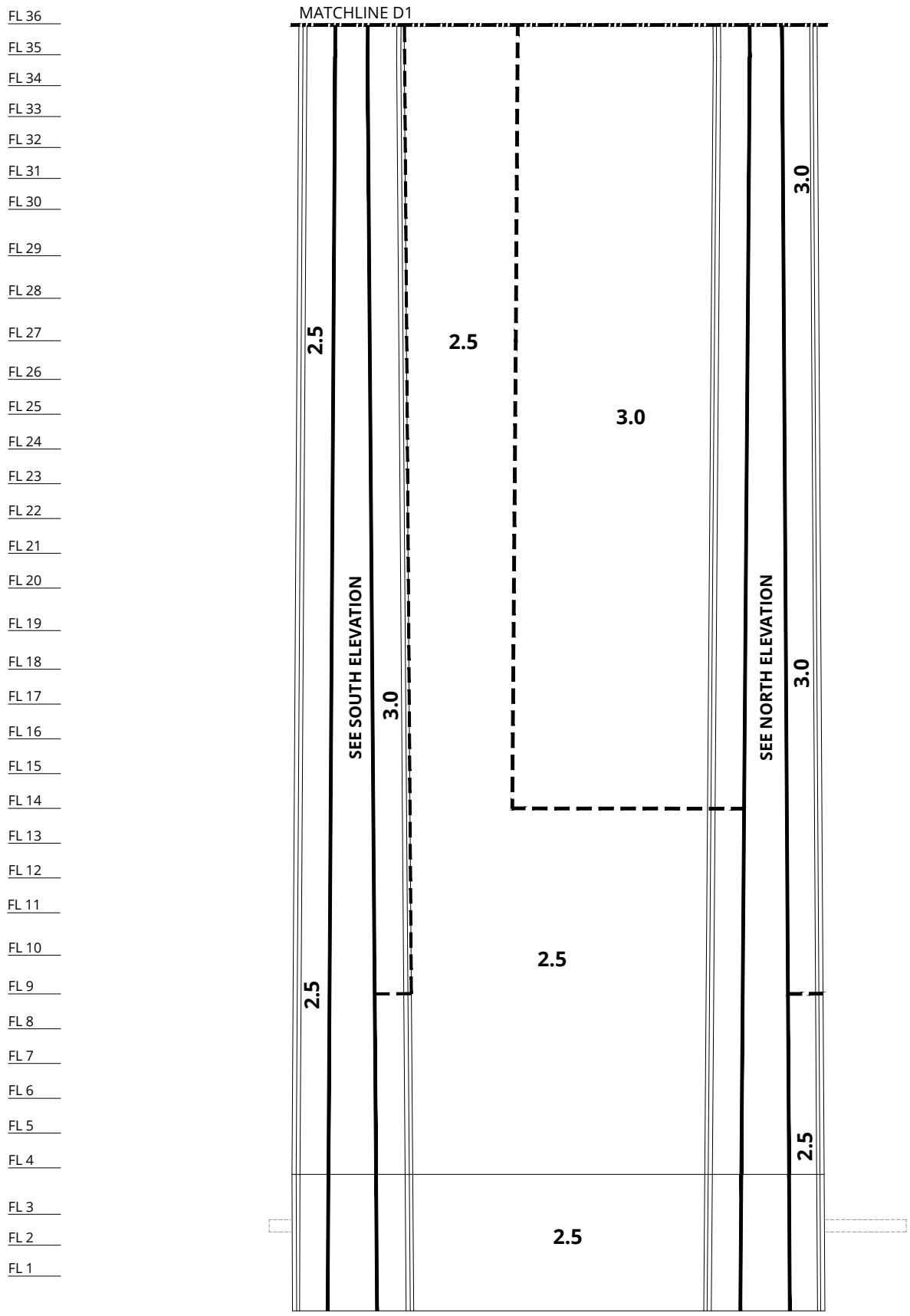


Isometric View of the Building



EAST ELEVATION

0 10 30m

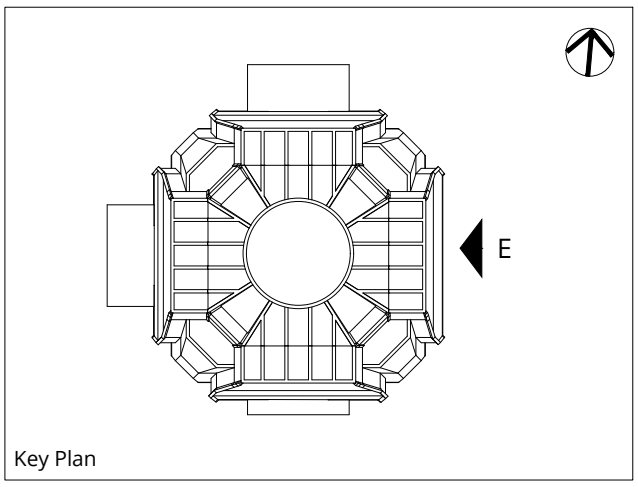
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 7a
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Note:
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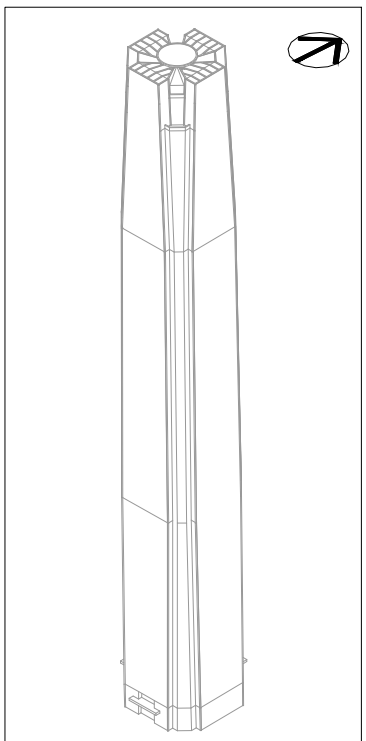
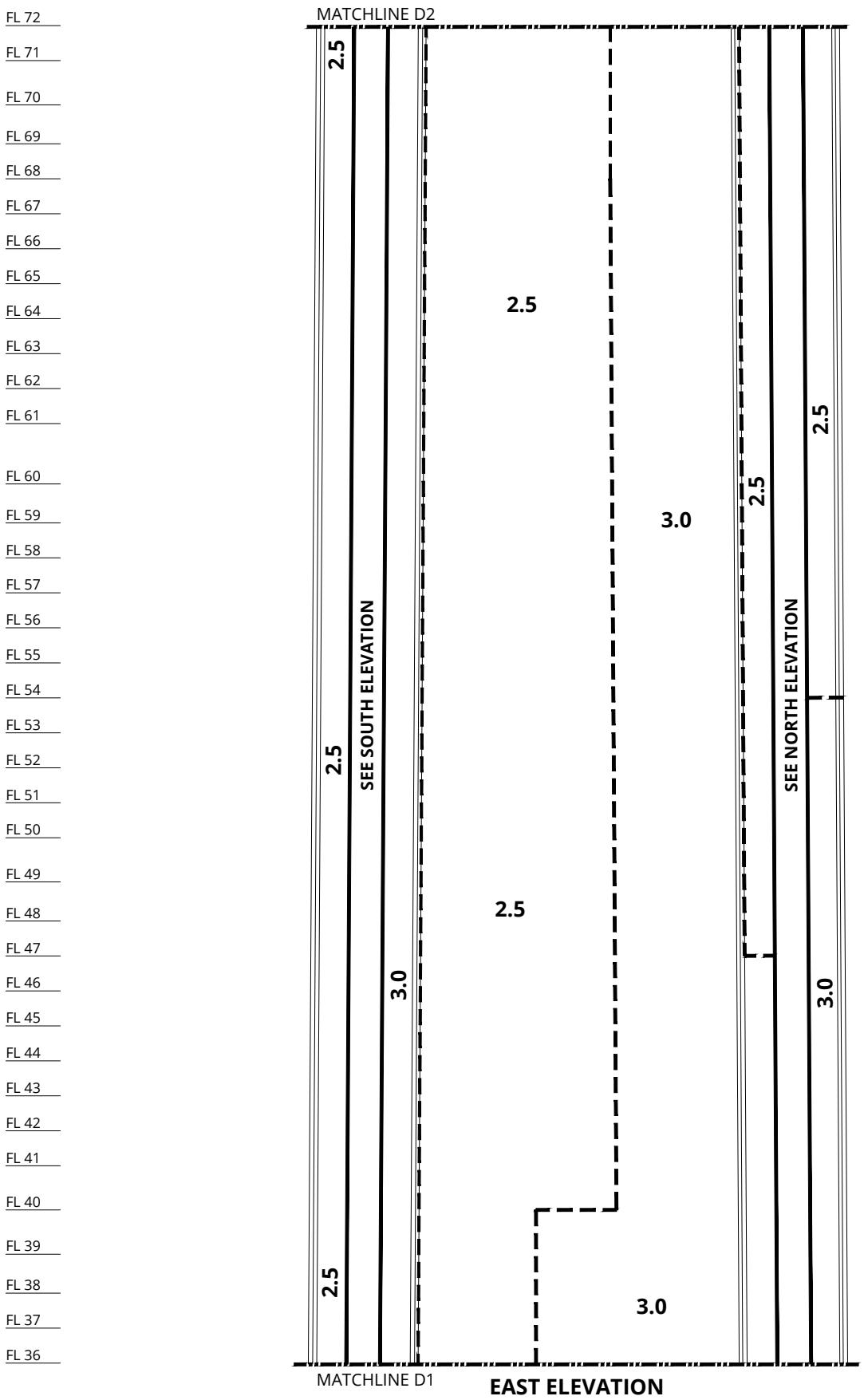




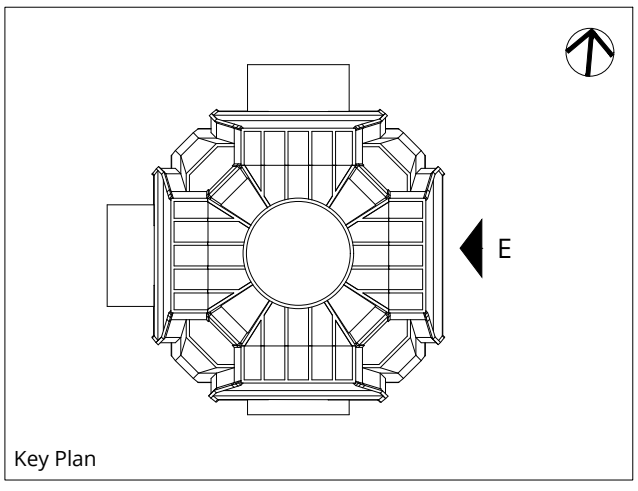
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 7b
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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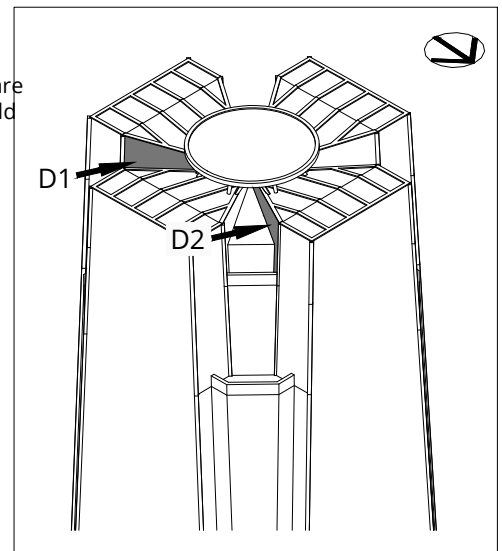
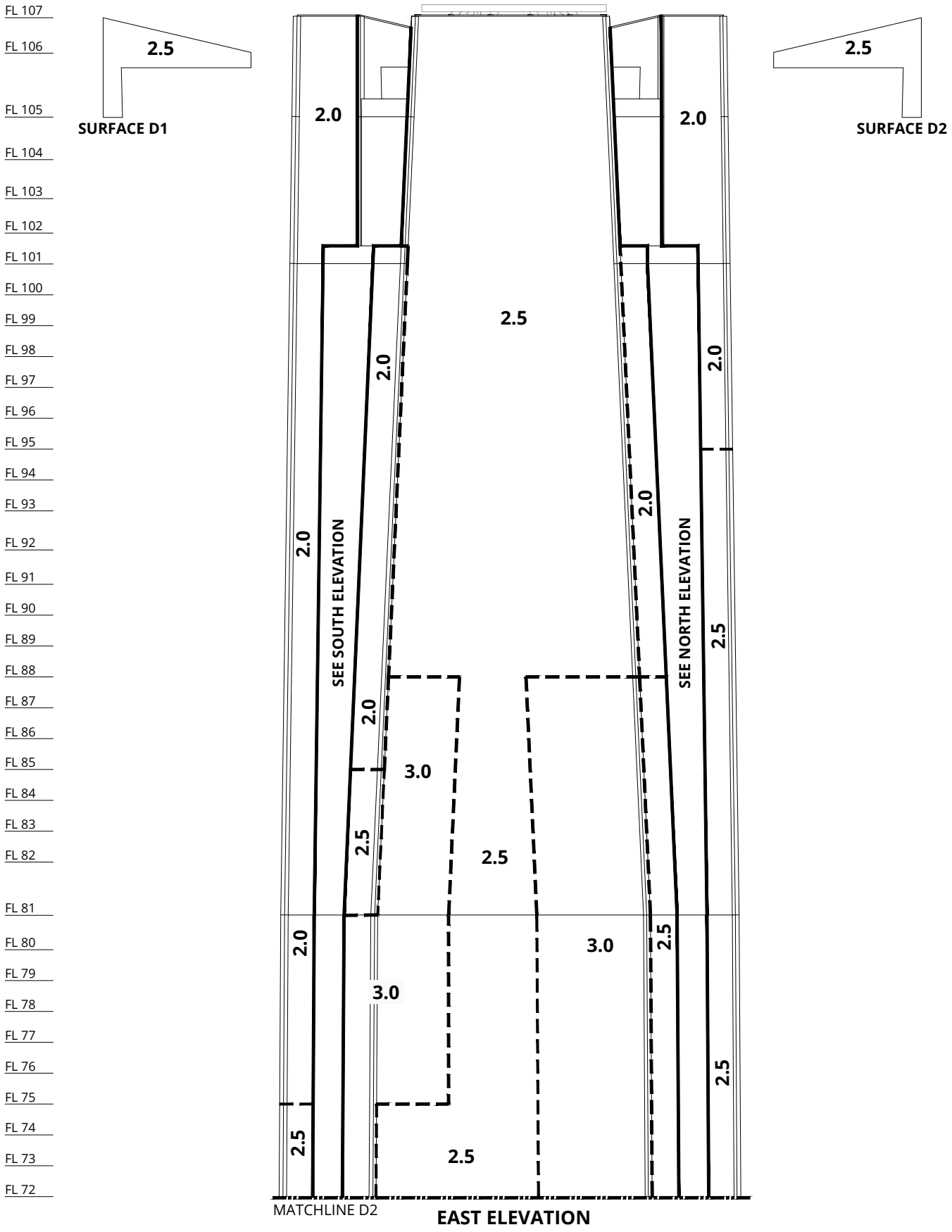


Key Plan of Wall Surfaces (D)



0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR | Figure: 7c
Approx. Scale: 1:750
Date Revised: Mar. 16, 2020

Note:
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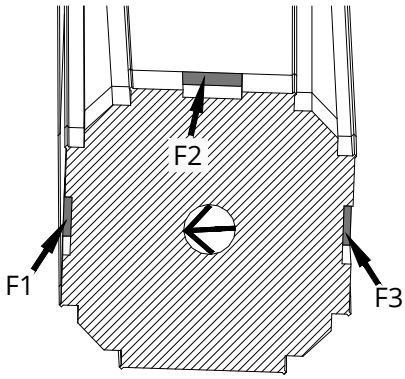
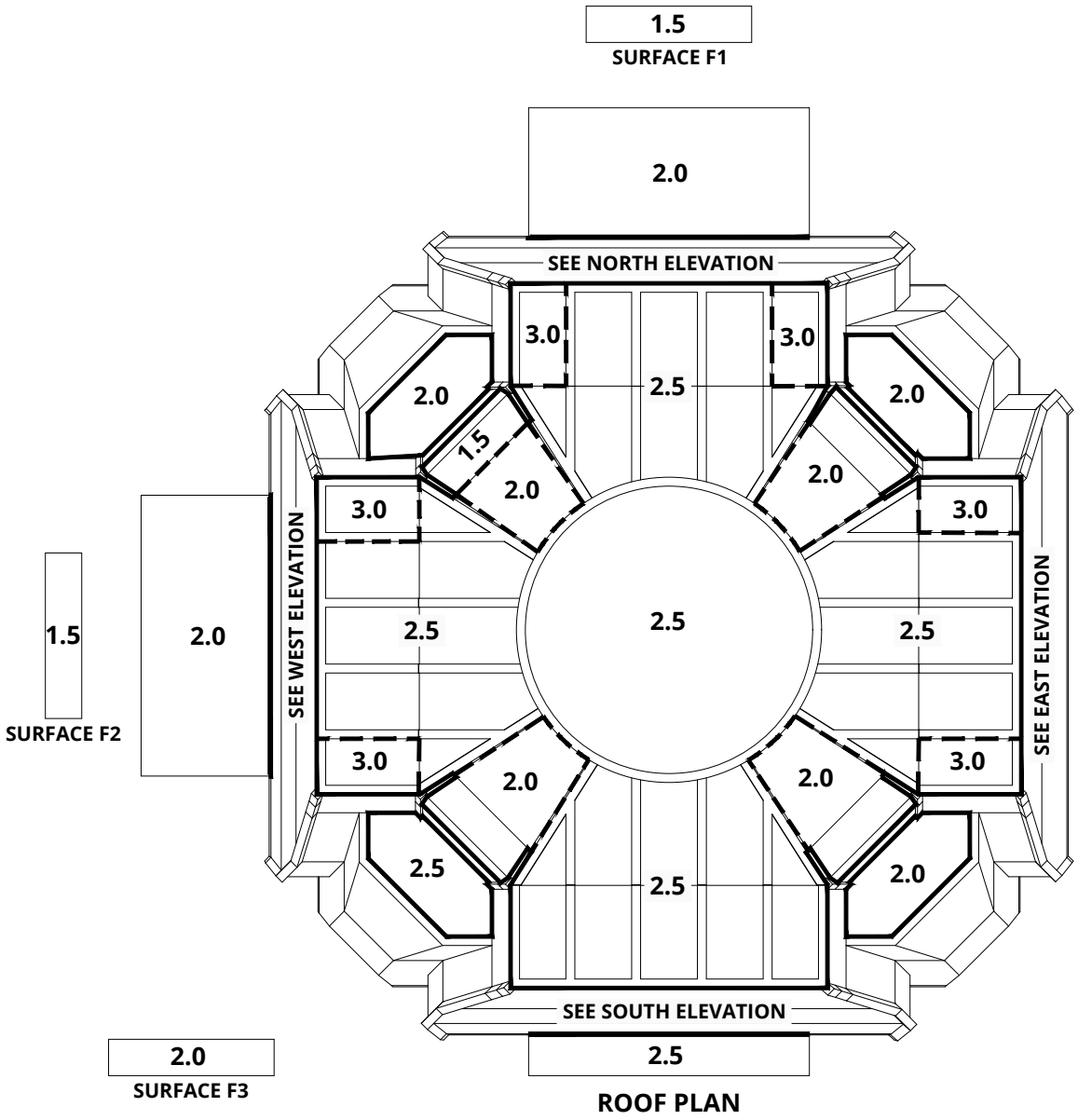


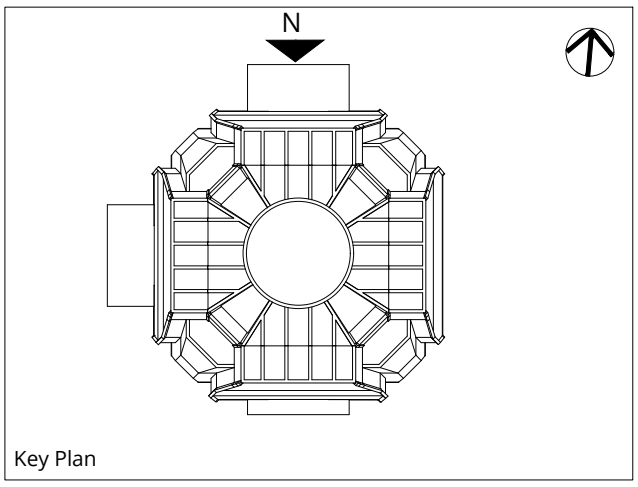
Reflected Soffit Surfaces (F)



Recommended Wind Loads for Cladding Design (kPa)
Peak Net Negative Pressures
(Negative External Pressure with Positive Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0
True North

Suzhou Zhongnan Center - Suzhou, China
Project #1904462

Drawn by: MBR	Figure: 8
Approx. Scale:	1:600
Date Revised:	Mar. 16, 2020



Note:
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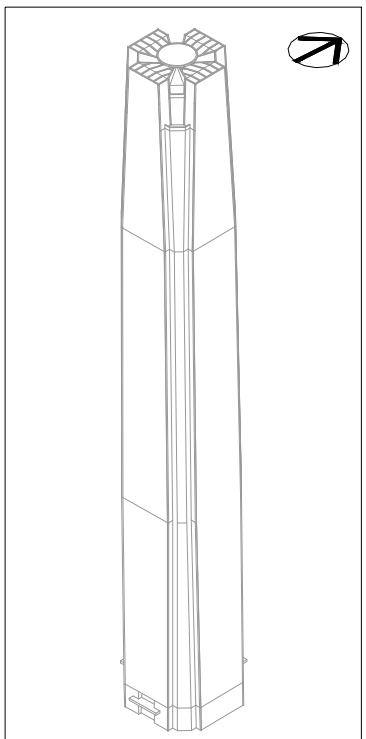
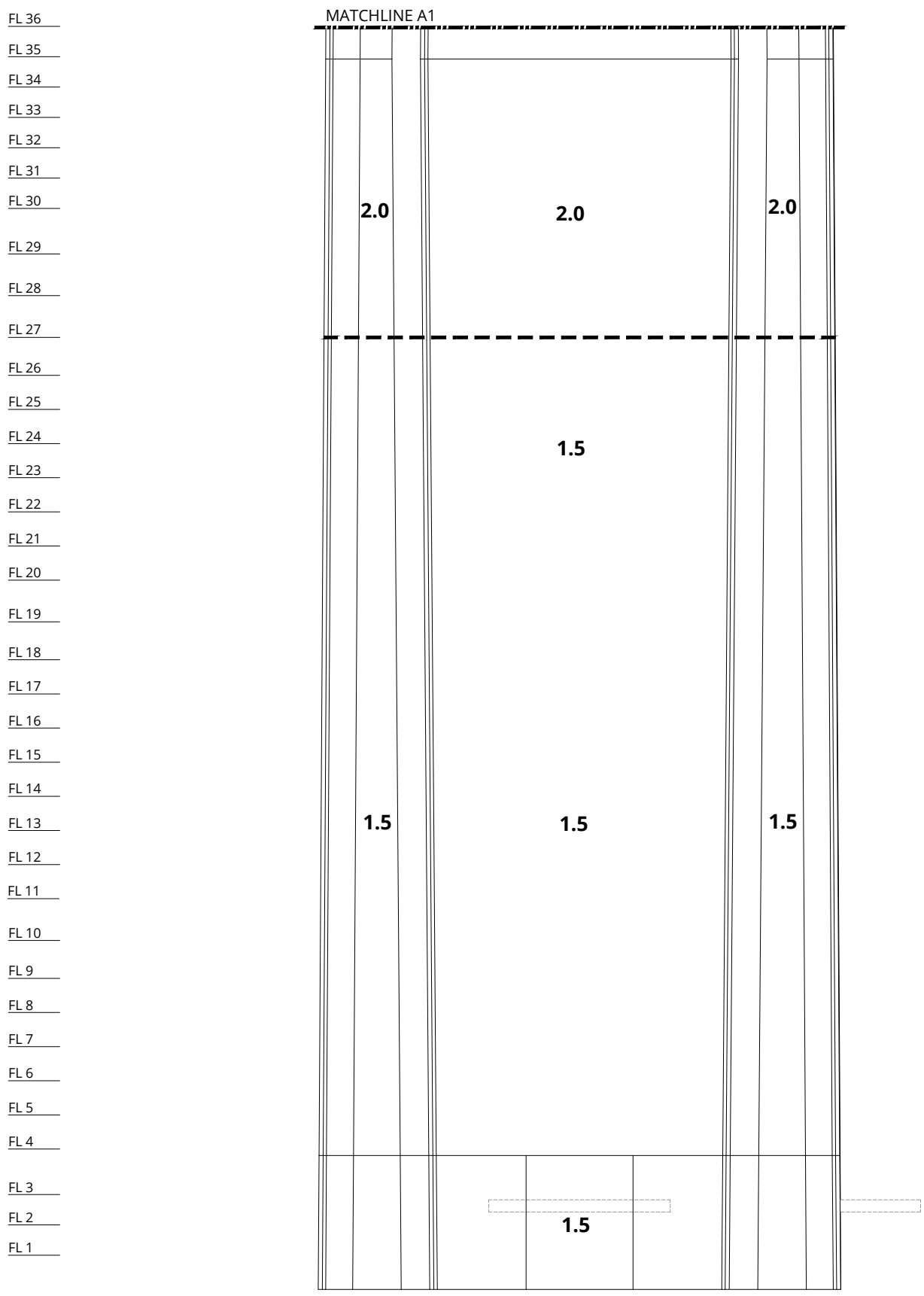

Isometric View of the Building



NORTH ELEVATION

0 10 30m

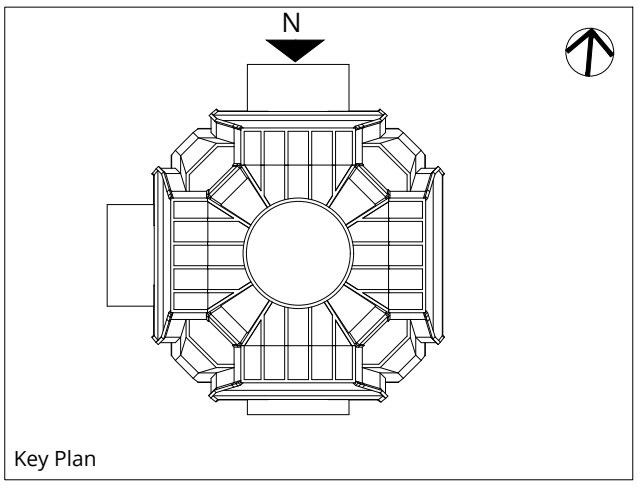
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

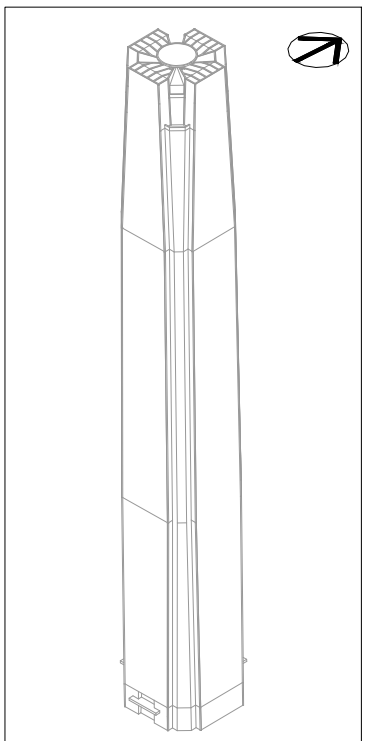
Project #1904462

Drawn by: MBR	Figure: 9a
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020

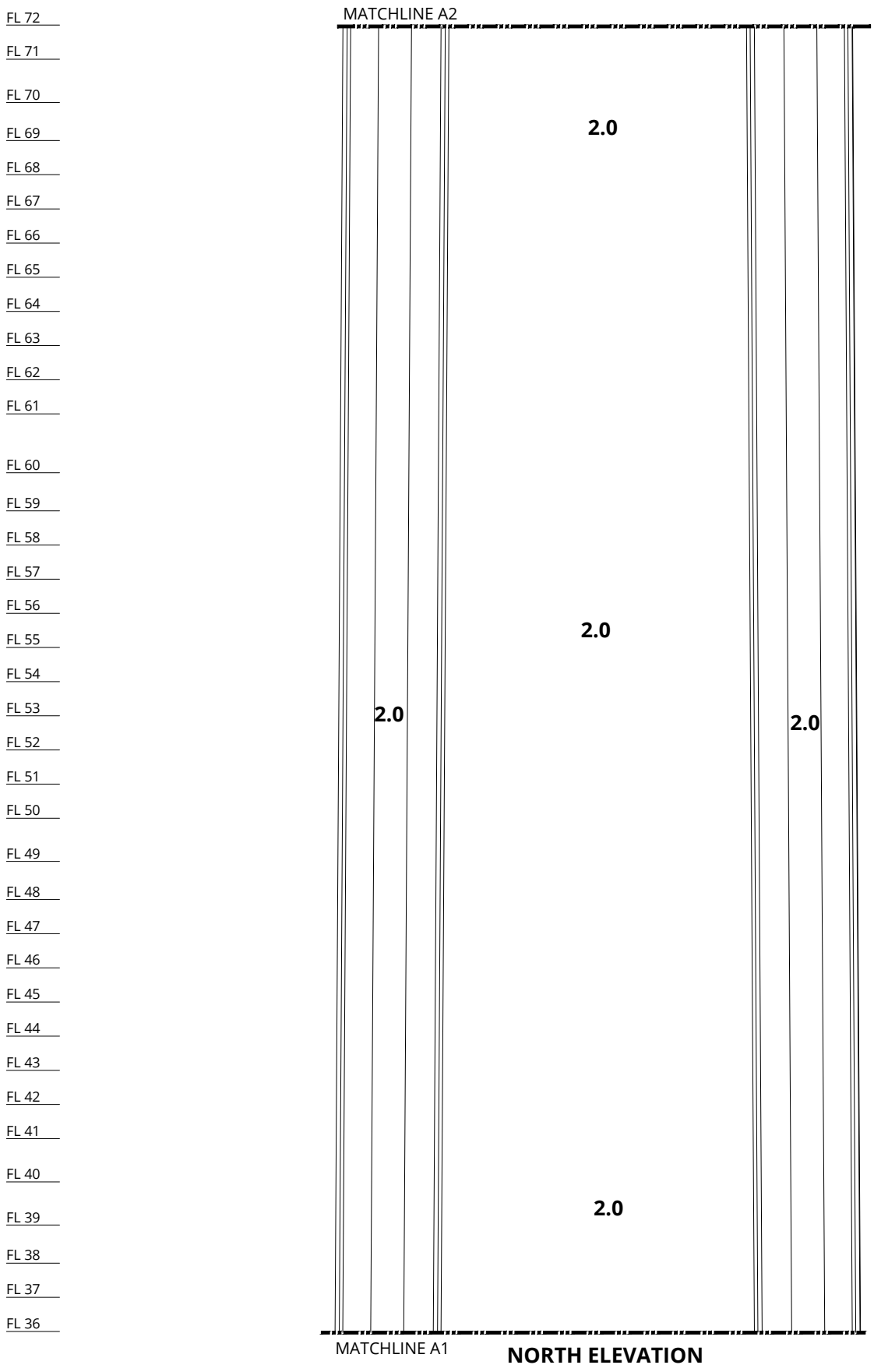


Key Plan

Note:
The wind loads presented ***do not*** contain load or safety factors. The loads are to be applied to the building's cladding system in the same manner as would wind loads calculated by building code analytical methods.



Isometric View of the Building



NORTH ELEVATION

0 10 30m

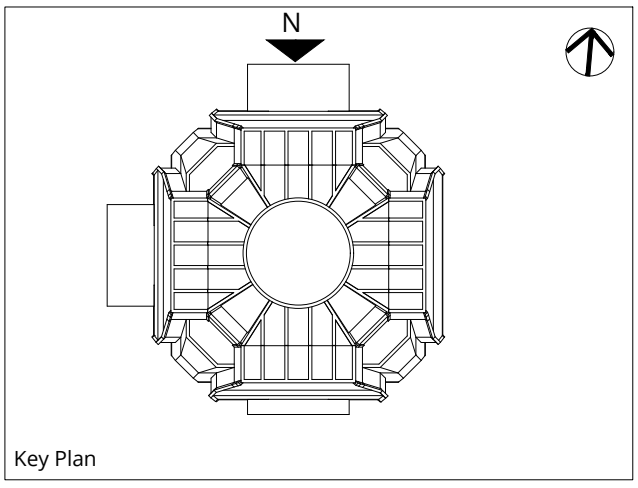
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 9b
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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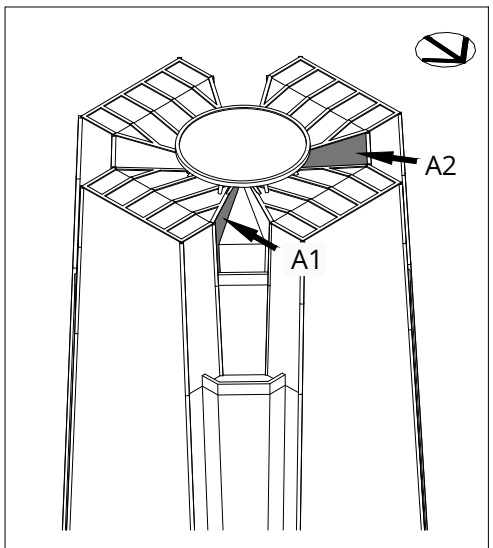

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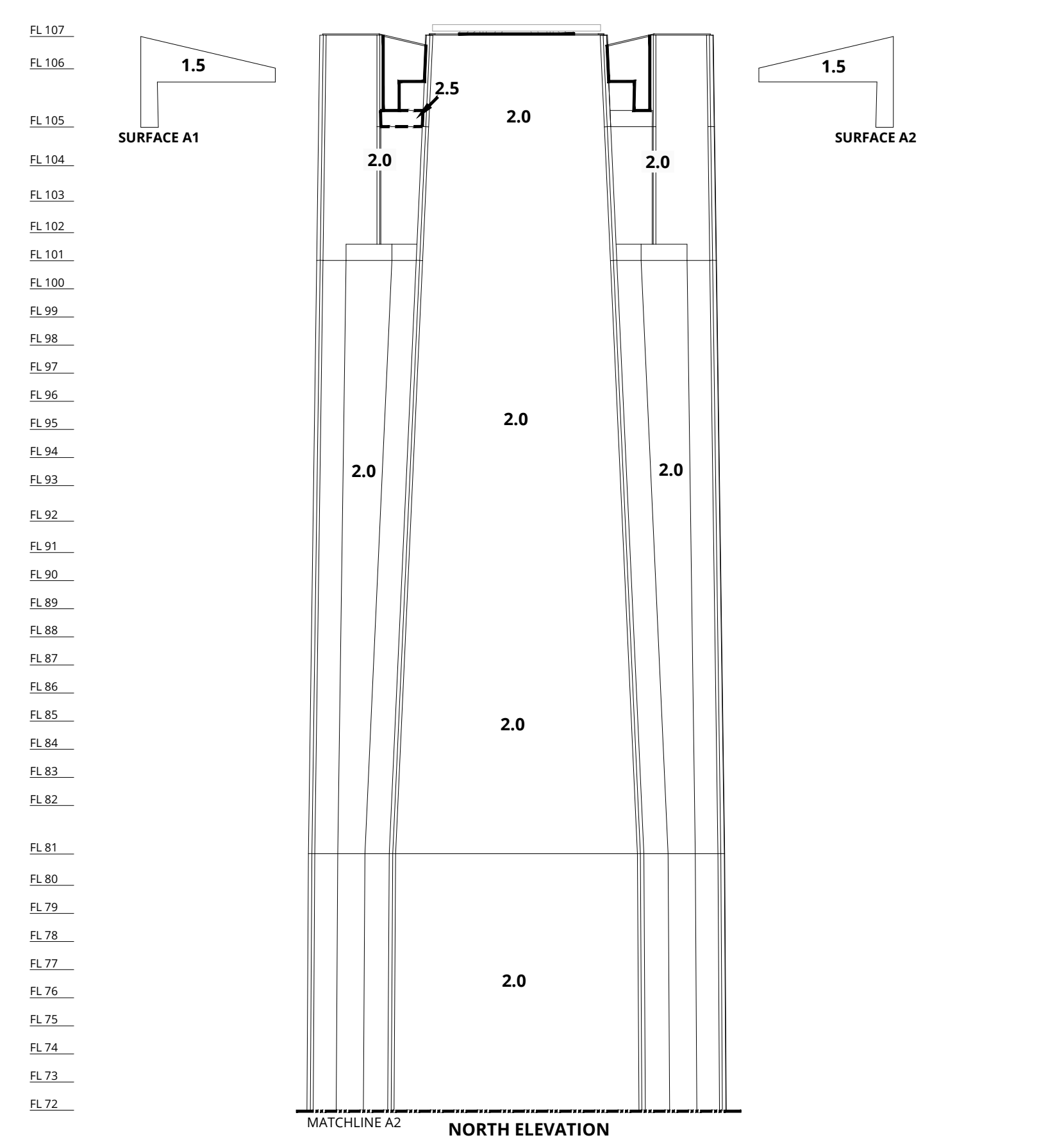


NORTH ELEVATION

0 10 30m

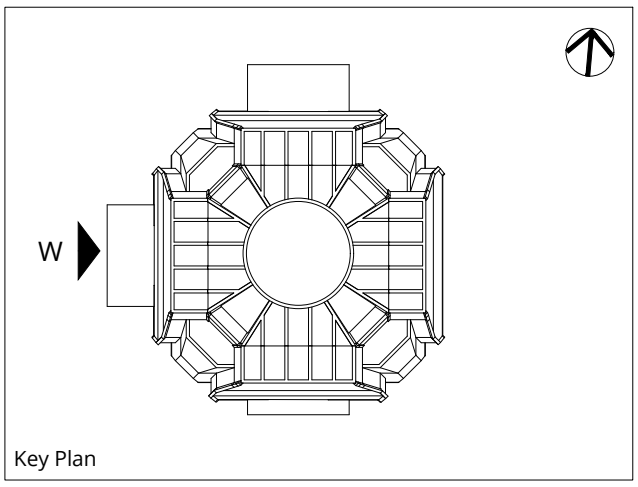
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 9c
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Note:
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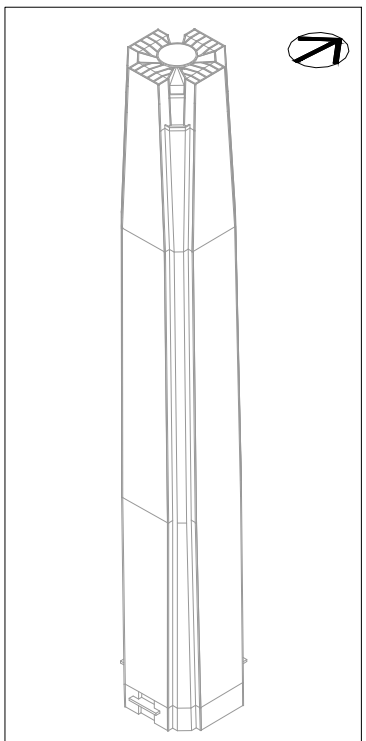
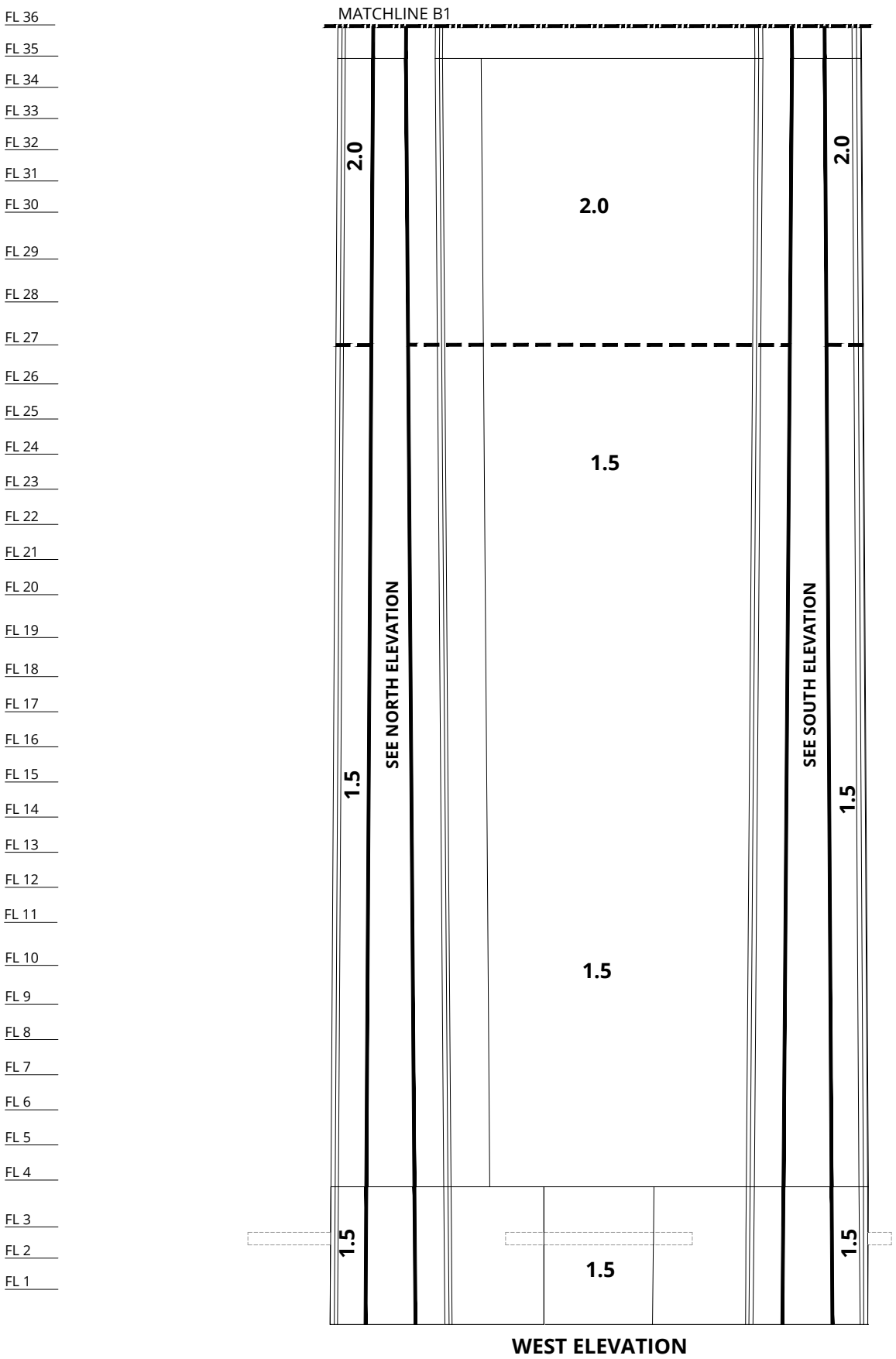

Isometric View of the Building



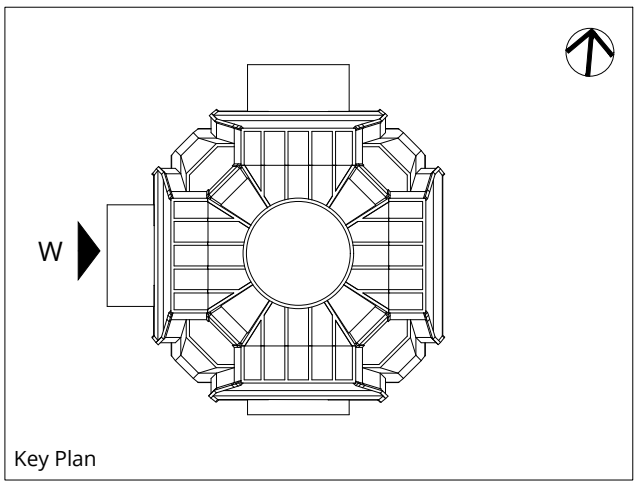
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 10a
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Note:
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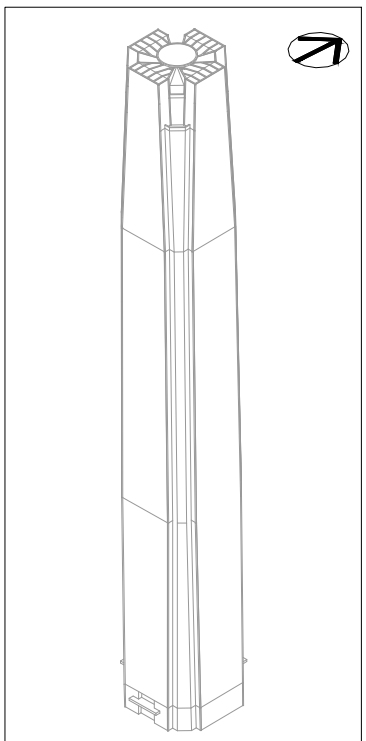
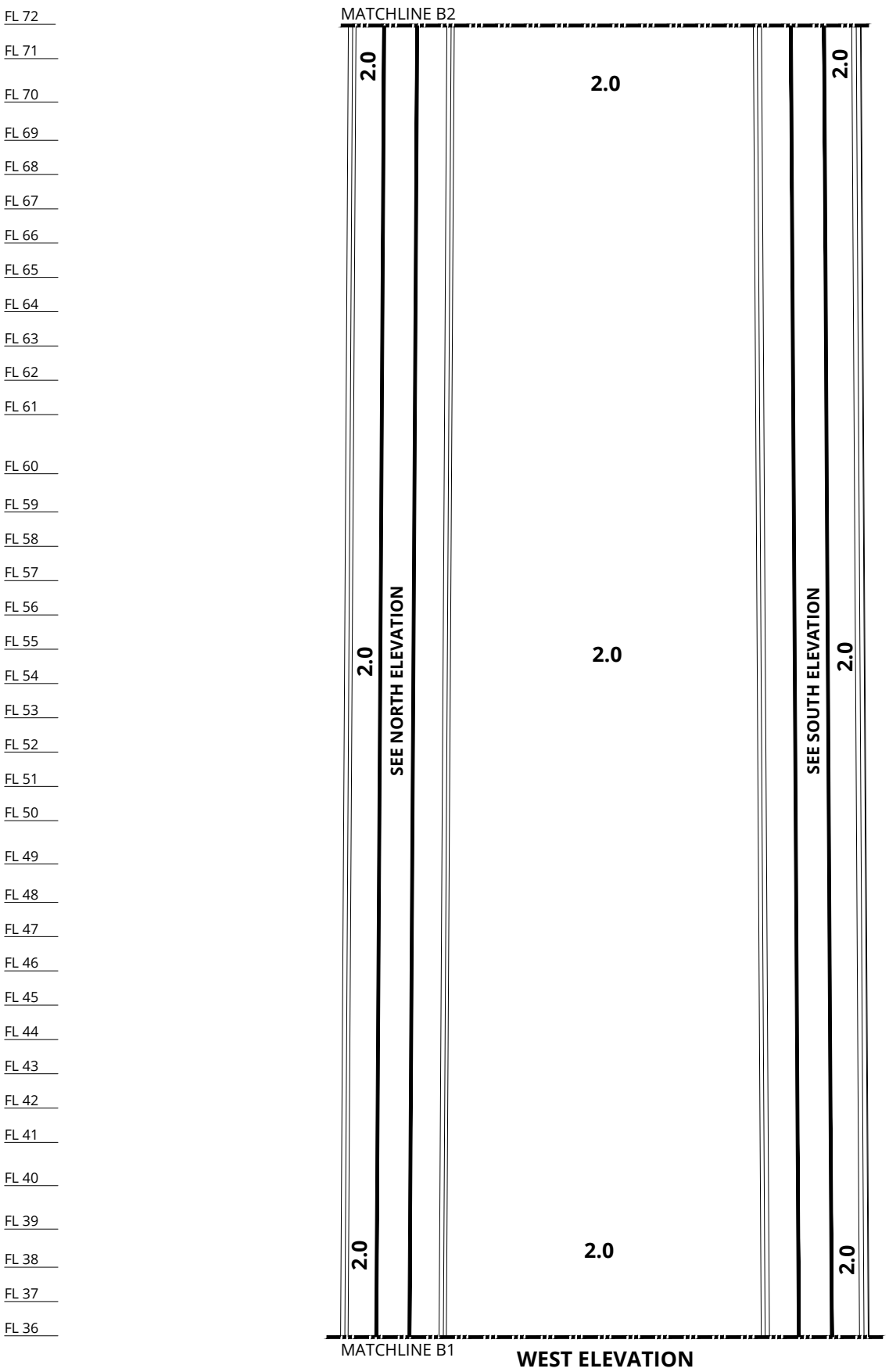

Isometric View of the Building



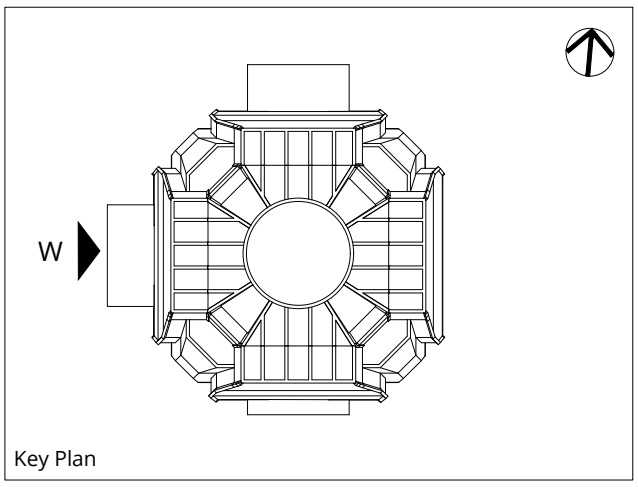
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 10b
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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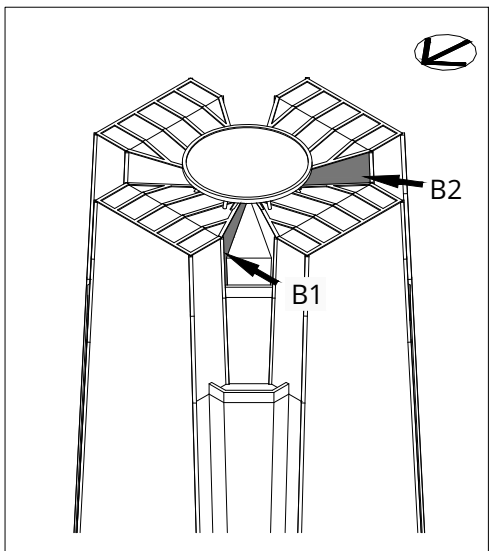
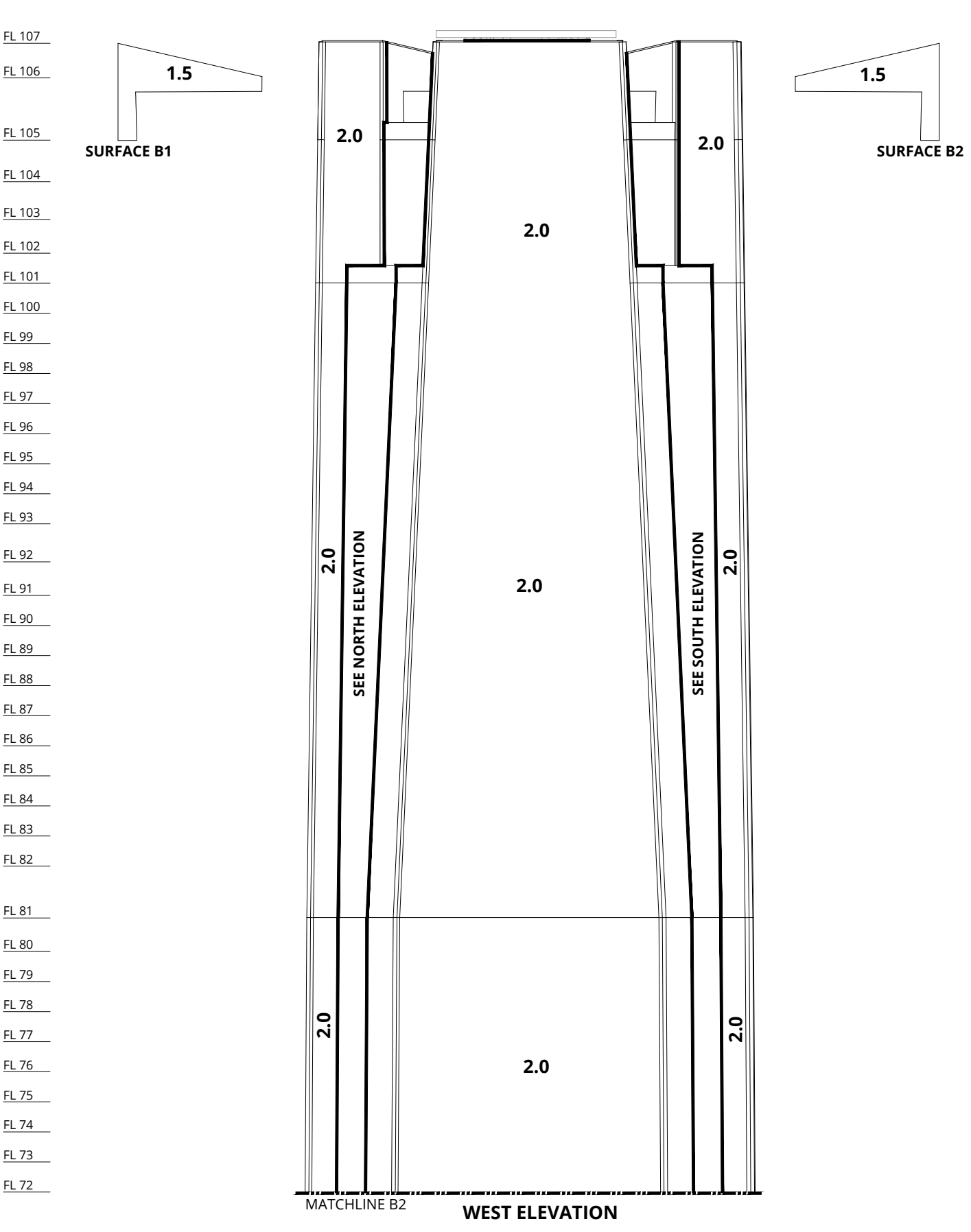


Key Plan of Wall Surfaces (B)



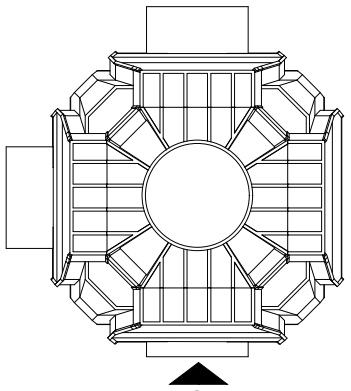
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 10c
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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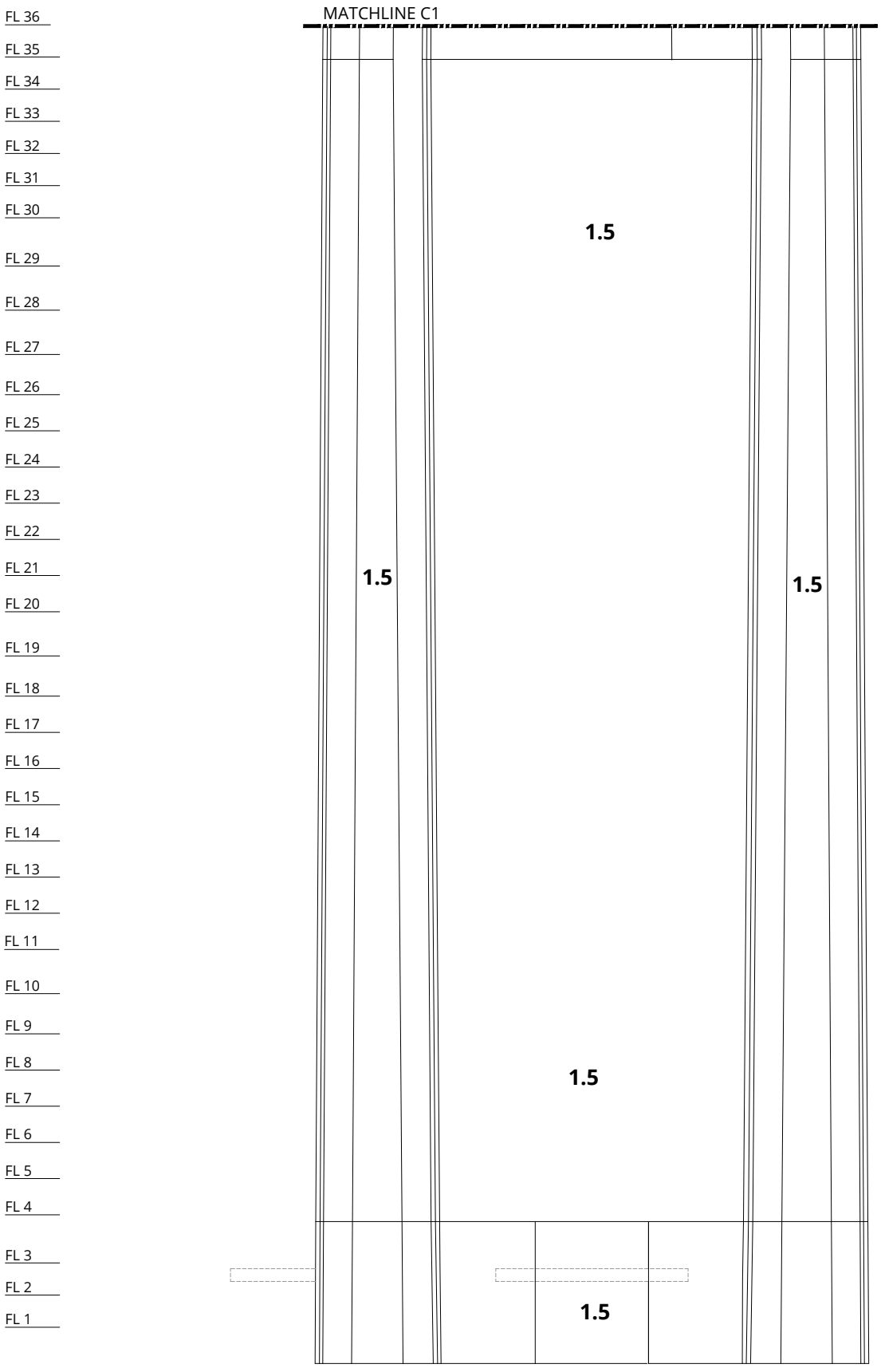
Isometric View of the Building



SOUTH ELEVATION

0 10 30m

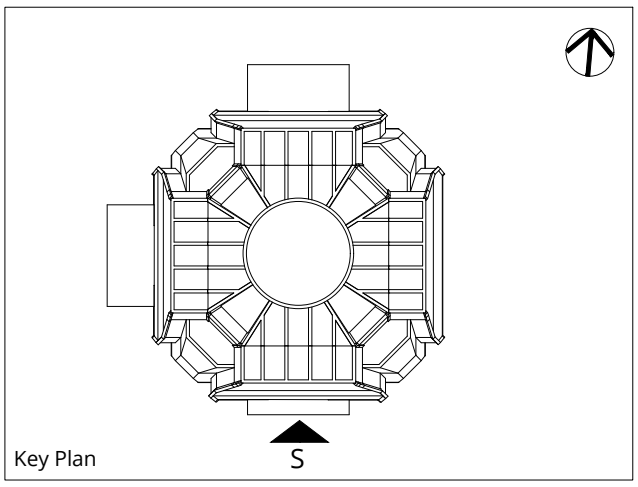
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

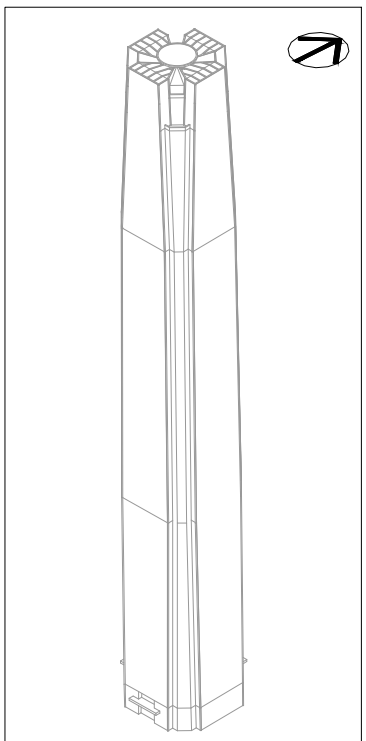
Project #1904462

Drawn by: MBR	Figure: 11a
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020

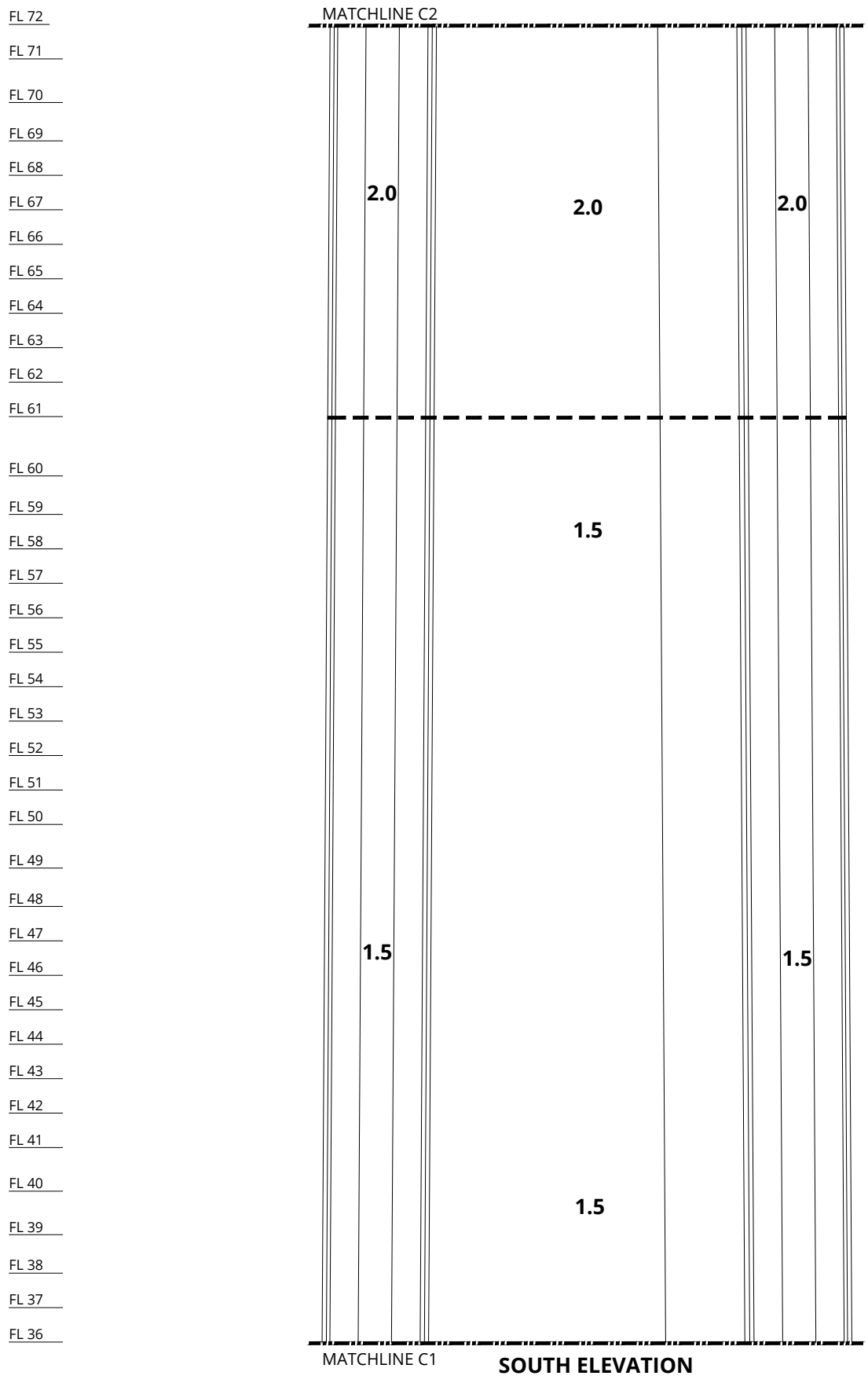


Key Plan

Note:
The wind loads presented ***do not*** contain load or safety factors. The loads are to be applied to the building's cladding system in the same manner as would wind loads calculated by building code analytical methods.



Isometric View of the Building



SOUTH ELEVATION

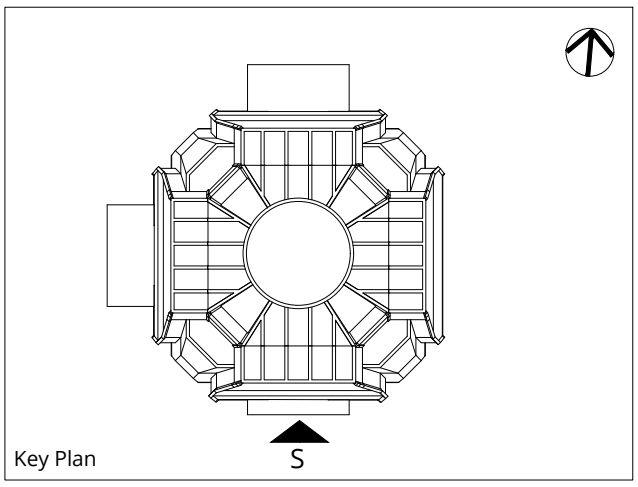
0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 11b
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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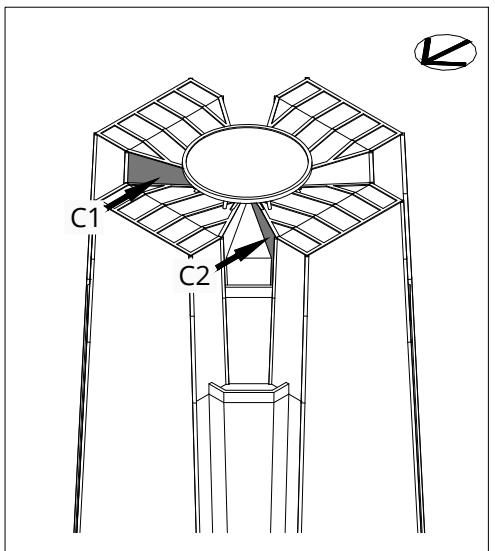
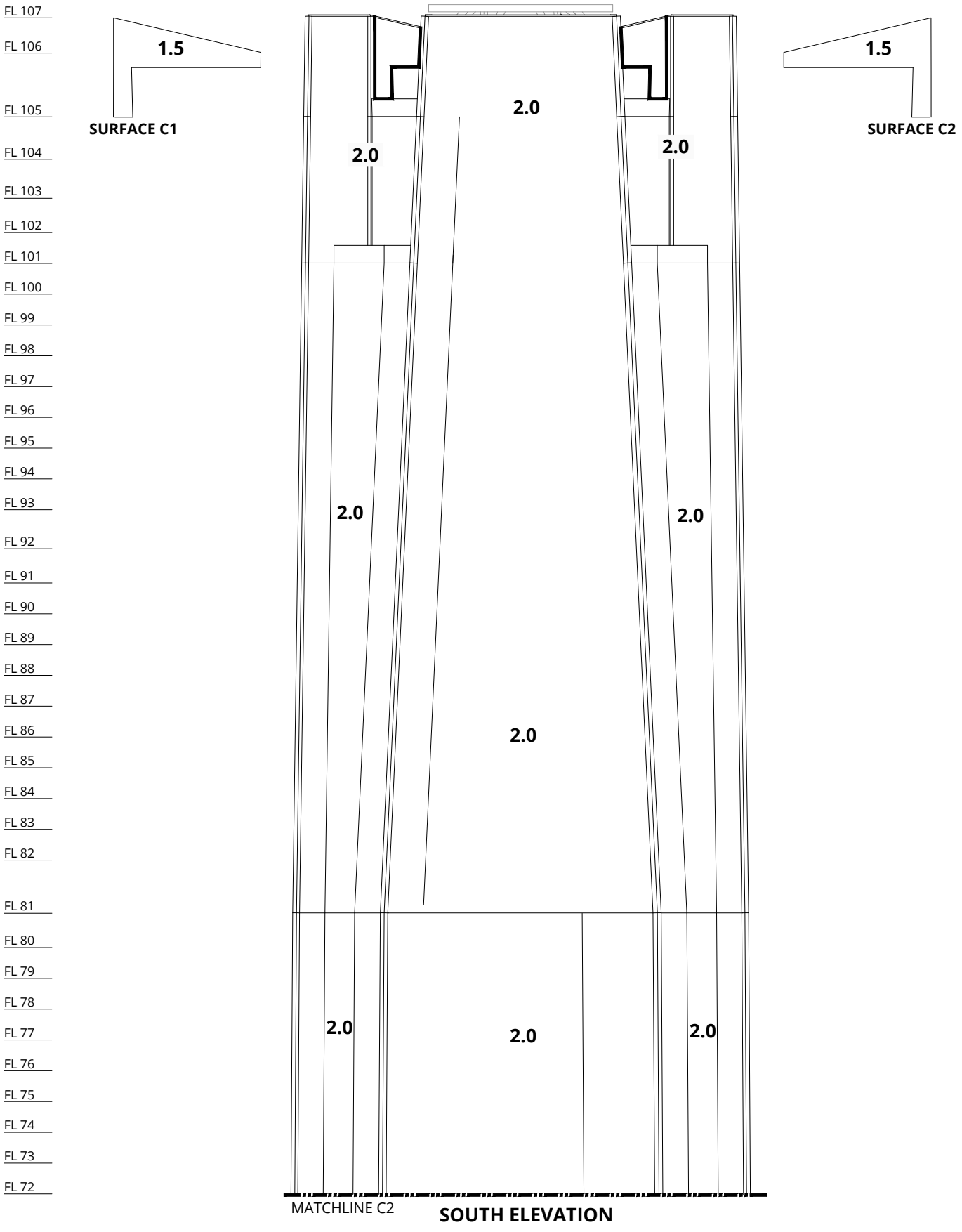


Key Plan of Wall Surfaces (C)



SOUTH ELEVATION

0 10 30m

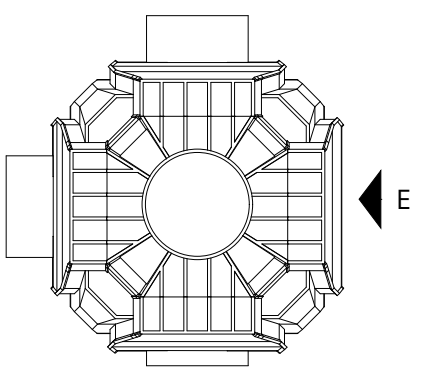
Recommended Wind Loads for Cladding Design (kPa)

Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 11c
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020



Key Plan

Note:
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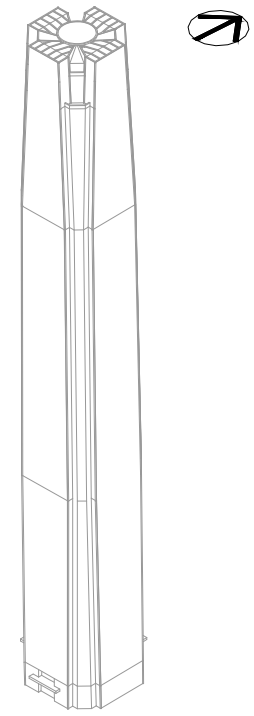
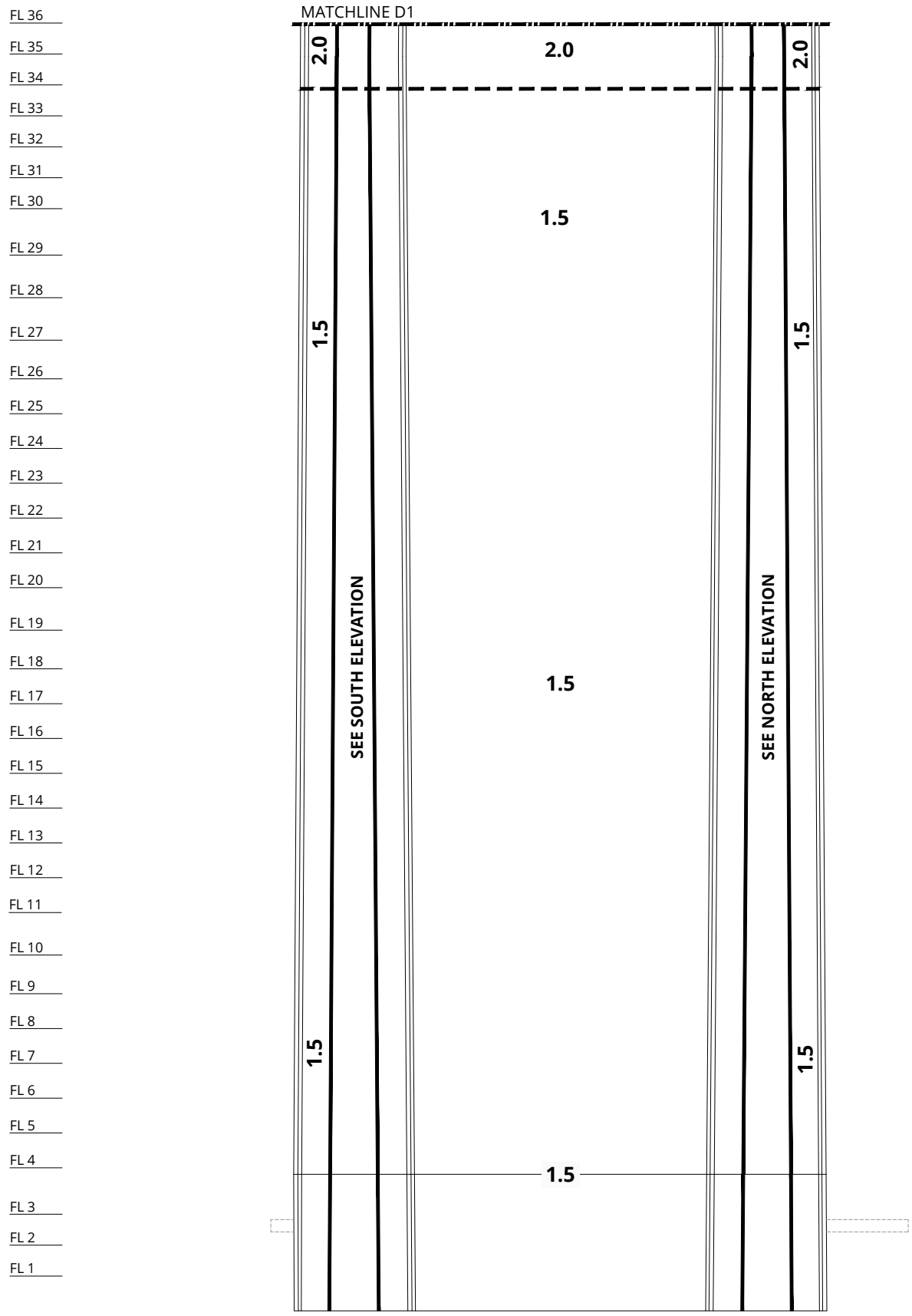


Isometric View of the Building



EAST ELEVATION

0 10 30m

Recommended Wind Loads for Cladding Design (kPa)

Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 12a
Approx. Scale:	1:750
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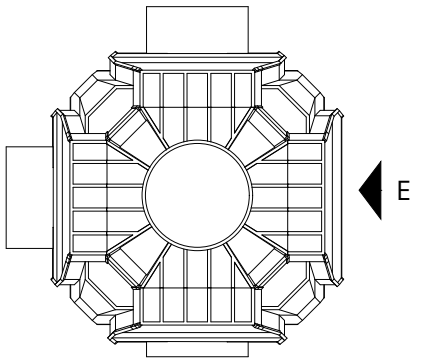

Key Plan

Note:
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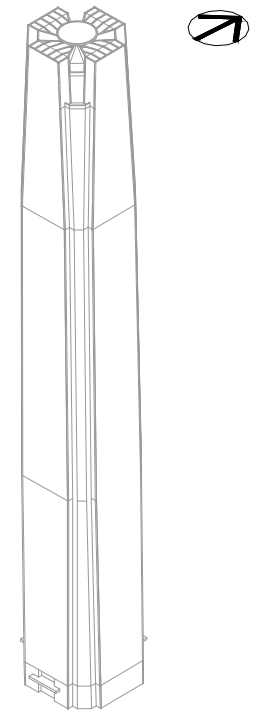
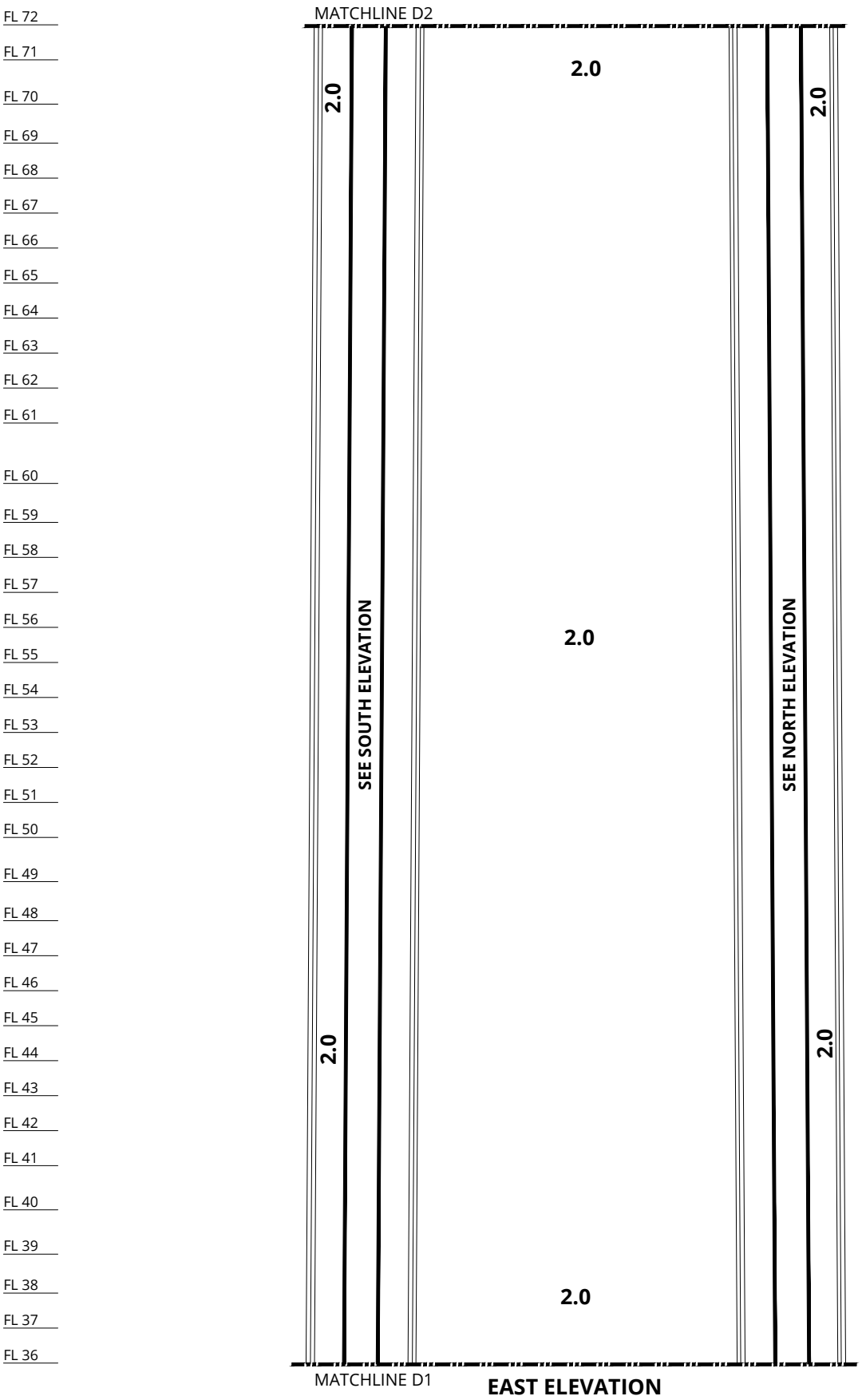


Isometric View of the Building



EAST ELEVATION

0 10 30m

Recommended Wind Loads for Cladding Design (kPa)

Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 12b
Approx. Scale:	1:750
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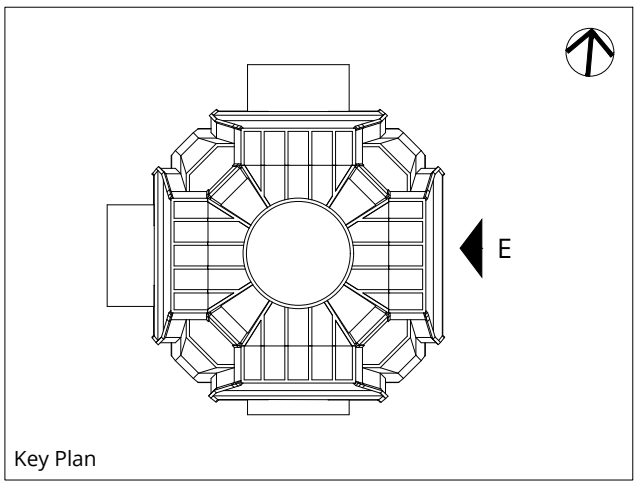

Key Plan

Note:
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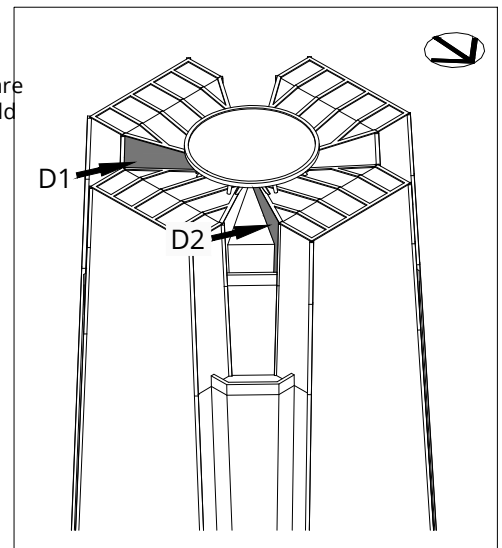
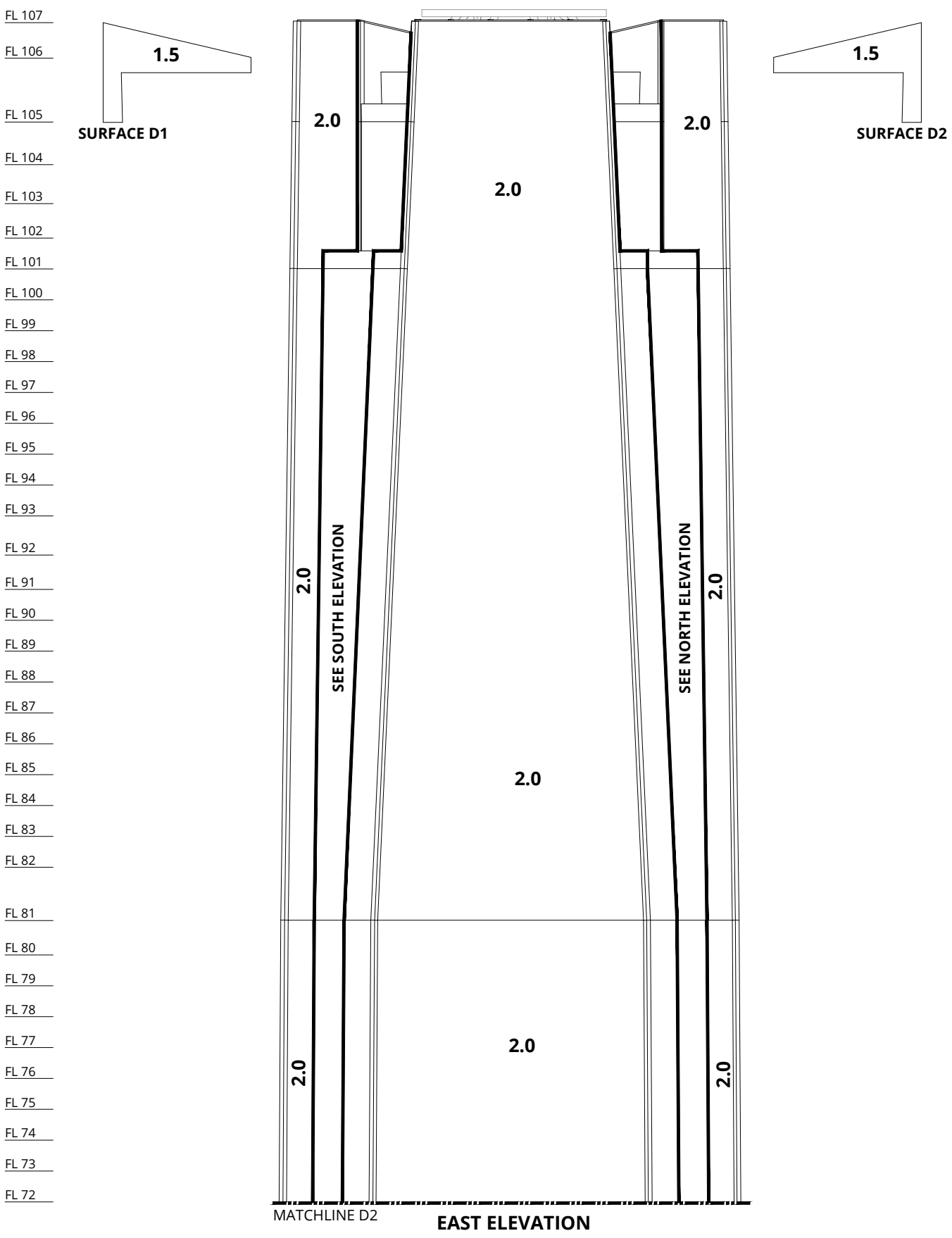


Key Plan of Wall Surfaces (D)



0 10 30m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

Suzhou Zhongnan Center - Suzhou, China

Project #1904462

Drawn by: MBR	Figure: 12c
Approx. Scale:	1:750
Date Revised:	Mar. 16, 2020

Note:
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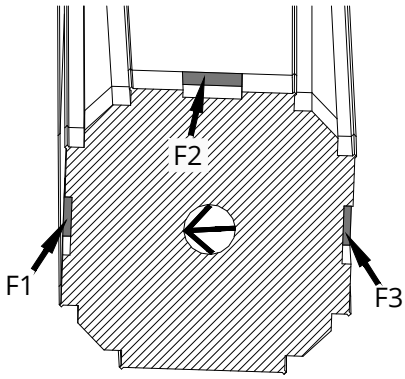
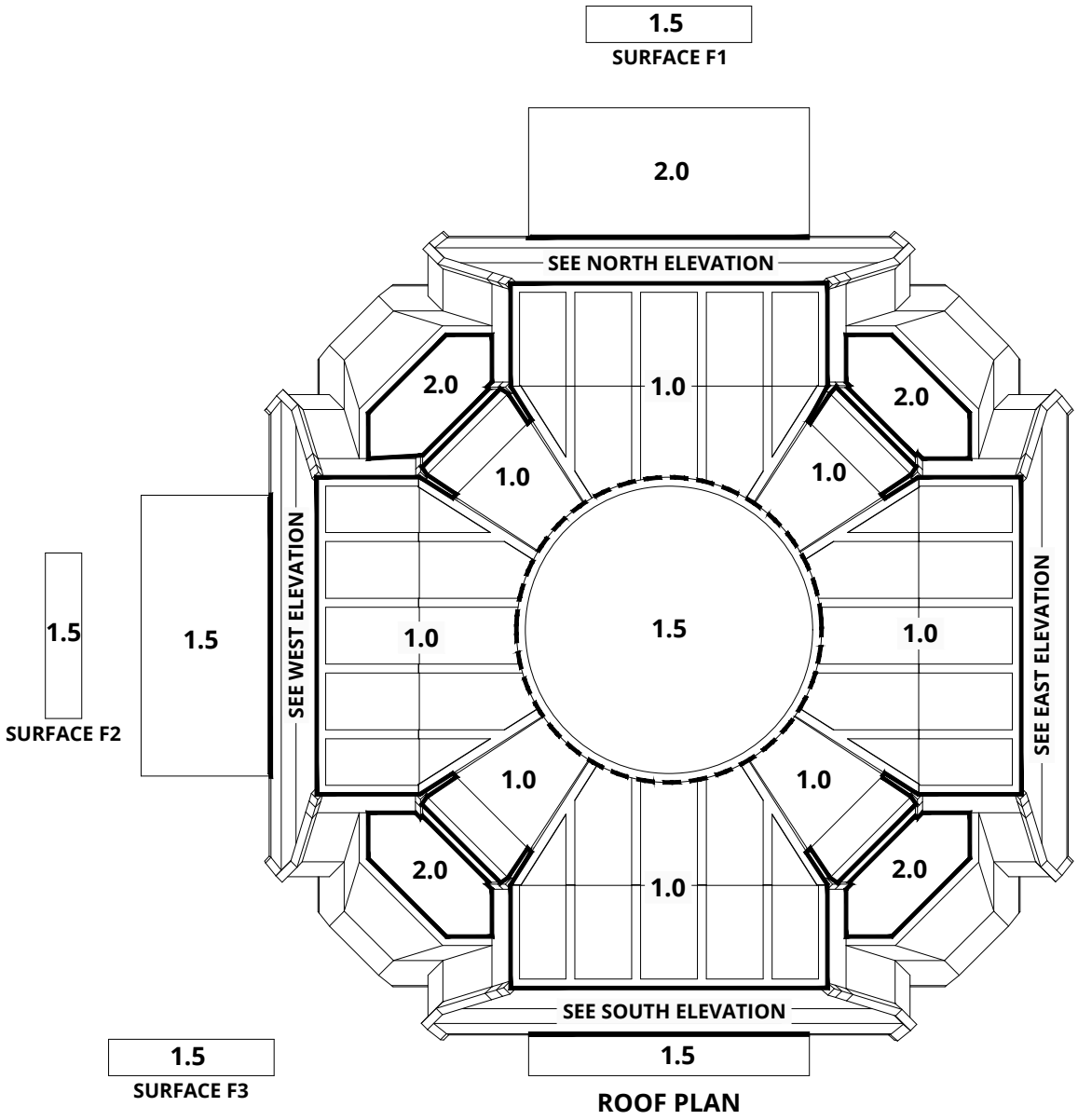


Reflected Soffit Surfaces (F)



ROOF PLAN

0 10 25m

Recommended Wind Loads for Cladding Design (kPa)
Peak Net Positive Pressures
(Positive External Pressure with Negative Internal Pressure Where Applicable)
50-Year Reference Wind Pressure = 0.45 kN/m^2 (10-Minute Mean), Importance Factor = 1.0

True North

Suzhou Zhongnan Center - Suzhou, China Project #1904462

Drawn by: MBR	Figure: 13
Approx. Scale:	1:600
Date Revised:	Mar. 16, 2020

APPENDIX A

APPENDIX A: WIND TUNNEL PROCEDURES

OVERVIEW OF WIND TUNNEL PROCEDURES FOR THE PREDICTION OF CLADDING WIND LOADS

A.1 Wind Tunnel Test and Analysis Methods

A.1.1 Wind Tunnel Tests

RWDI's boundary layer wind tunnel facility simulates the mean speed profile and turbulence of the natural wind approaching the modeled area by having a long working section with a roughened floor and specially designed turbulence generators, or spires, at the upwind end. Floor roughness and spires have been selected to simulate four basic terrain conditions, ranging from open terrain, or water, to built-up urban terrain. During the tests, the upwind profile in the wind tunnel is set to represent the most appropriate of these four basic profiles, for directions with similar upwind terrain. Scaling factors are also introduced at the analysis stage to account for remaining minor differences between the expected wind speed and turbulence properties, and the basic upwind flow conditions simulated in the wind tunnel. The full-scale properties are derived using the ESDU methodology[1, 2] for predicting the effect of changes in the earth's surface roughness on the planetary boundary layer. For example, this procedure distinguishes between the flows generated by a uniform open water fetch upwind of the site, versus a short fetch of suburban terrain immediately upwind of the site with open water in the distance.

Wind direction is defined as the direction from which the wind blows in degrees measured clockwise from true north. The test model (study model and surroundings) is mounted on a turntable, allowing any wind direction to be simulated by rotating the model to the appropriate angle in the wind tunnel. The wind tunnel test is typically conducted for 36 wind directions at 10° intervals.

It is prudent to take steps to ensure that the safety of a structure is not entirely dependent on specific surrounding buildings for shelter. Building codes often contain specific provisions to address this. These may include requirements to test with the more significant surrounding buildings removed, and/or lower limits on the reduction that is permitted compared to the code analytical approach.

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1 Wind speed profiles over terrain with roughness changes for flat or hilly sites. Item No. 84011, ESDU International London, 1984 with amendments to 1993.

2 Longitudinal turbulence intensities over terrain with roughness changes for flat or hilly sites. Item No. 84030, ESDU International London, 1984 with amendments to 1993.

A.1.2 Measurement Techniques

This study addresses the local wind pressures that act on the exterior envelope of the building. Predictions of these loads are required in order that the cladding system can be designed to safely resist the wind loads. The technique that is used to make these predictions consists of conducting a wind pressure study. The basis of the approach is to instrument a rigid wind tunnel model of the building with pressure taps that adequately cover the exterior areas exposed to wind. The mean pressure, the root-mean-square of pressure fluctuations and the peak negative and peak positive pressures are measured at each tap using a system capable of responding to pressure fluctuations as short as 0.5 to 1 second at full scale. The measured data are converted into pressure coefficients based on the measured upper level mean dynamic pressure in the wind tunnel. Time series of the simultaneous pressures are also recorded for post-test processing if required. A typical example of an instrumented wind tunnel study model is provided in Figure 1.

A.1.3 Consideration of the Local Wind Climate

Carrying out the procedures described in the previous sections determines the peak local external pressure coefficients expected for a given wind direction. However, in order to account for the varying likelihood of different wind directions and the varying strengths of winds that may be expected from different directions, the measured pressure coefficients are integrated with statistical records of the local wind climate to produce predicted peak pressures as a function of return period. In the case of cladding loads, it is appropriate to consider peak loads associated with return periods comparable to the design life of the structure. The choice of return period will be governed by local code requirements that consider the intended use of the building. For Allowable Stress Design, return periods of 50 or 100 years are often used for cladding design, to which appropriate load or safety factors are applied. For Limit States Design, return periods of 700 or 1700 years, without load or safety factors, are used to represent the ultimate state loading.

Wind records taken from one or more locations near to the study site are generally used to derive the wind climate model. In areas affected by hurricanes or typhoons, Monte Carlo simulations are typically used to generate a better database since full scale measurements, if available for a given location, typically provide an inadequate sample for statistical purposes. The data in either case are analysed to determine the probabilities of exceeding various hourly mean wind speeds from within each of 36 wind sectors at an upper level reference height, typically taken to be 600 m (2000 ft) above open terrain. This coincides with the height used to measure the reference dynamic pressure in the wind tunnel.

In order to predict the cladding wind loads for a given return period, the wind tunnel results are integrated with the wind climate model. There are two methods typically used by RWDI to perform this integration. In one method, the historical (or simulated as is the case with hurricanes or typhoons) wind record is used to determine the full-scale cladding wind pressures for each hour, given the recorded wind speed and direction and the wind tunnel predictions for that direction. By stepping through the wind speed and direction data on an hour-by-hour basis, a time history of the resulting peak pressure is generated. Then, through the use of extreme value fitting techniques, statistically valid peak responses for any desired return period are determined.

The second method is the Upcrossing Method as described by Irwin[3] and Irwin and Sifton[4]. In simple terms, this can be thought of as an analytical representation of the first method, in which a fitted mathematical model of the wind statistics is used in place of the detailed wind records themselves. The Upcrossing Method is currently used by RWDI for cladding wind load studies.

A.1.4 Design Wind Speeds in Hurricane/Typhoon Regions

It may be of interest to compare design wind speeds with the Saffir-Simpson hurricane categories, although this should be done with caution. In particular, while associating the building strength or performance with a given category of hurricane may sound appealing, it ignores the likelihood of that category of storm actually occurring at a given site. It also ignores the distinction between a direct hit from a weak hurricane compared with a glancing blow from a strong one. For this reason, when adopting criteria for both strength and serviceability, building codes and standards relate design wind speeds to return period rather than simply to storm categories or other similar systems.

The commentary to the ASCE 7-10 has a discussion in Section C6.26.5.1 regarding the relationship between the Basic Wind Speeds in the standard and the Saffir-Simpson scale. The Basic Wind speeds given currently in the ASCE 7 are 3-second gust speeds at 33 feet over land. The ASCE commentary also provides guidance on conversion to other wind speed durations *in the same terrain conditions*, which may be considered if the design wind speeds are taken from other sources.

Hurricane wind speeds commonly referred to with the Saffir-Simpson scale are 1-minute averages over water. The conversion between these different averaging times and terrain conditions is complicated by the fact that the effective roughness of the sea surface varies with wind speed. The ASCE commentary (Table C26.5-2) provides the following approximate conversions, reflecting research more current than was reflected in the ASCE 7-05:

Saffir/Simpson Hurricane Category	1-minute average speed, 33 ft (10 m) over water, mph (m/s)	3-second gust speed, 33 ft (10 m) over land, mph (m/s)
1	74-95 (33-43)	81-105 (36.2-46.9)
2	96-110 (44-49)	106-121 (47.4-54.1)
3	111-130 (50-58)	122-143 (54.5-63.9)
4	131-155 (59-69)	144-171 (64.4-76.4)
5	>155 (>69)	>171 (>76.4)

[3] Irwin, P.A., "Pressure Model Techniques for Cladding Loads", Journal of Wind Engineering and Industrial Aerodynamics 29 (1988), pg. 69-78.

[4] Irwin, P.A. and Sifton, V. L., "Risk Considerations for Internal Pressures", Journal of Wind Engineering and Industrial Aerodynamics, 77 & 78 (1998), pg. 715-723.

It should be kept in mind that the ASCE 7 uses ultimate wind speeds. While this is the case for some other codes and standards, there are others which work with shorter return period wind speeds with a load factor to produce a design load effect. When commenting on the implications of the various storm categories on a specific structure, it is important to consider the code intent, including any load factors if applicable.

A.1.5 Internal Pressure Allowances Considering Localized Breaches in the Building Façade

In strong winds, air leakage effects dominate the internal pressures. Other factors that influence them, but are usually of less significance, are the operation of mechanical ventilation systems and the stack effect. Important sources of air leakage include uniformly distributed small leakage paths over the building's envelope and larger leakage paths. These larger leakage paths include window breakage due to airborne debris in a windstorm and open doors or windows, in cases where they are operable. The internal pressure allowances can be influenced by many factors including the size and location of potential glass breakage, the internal compartmentalization of the building and the internal volumes. During a major storm event, glass breakage can be different sizes and occur at various locations. There are many types of projectiles that typically cause glass breakage, ranging in size from small rocks to tree branches. Larger projectiles impacting the building would be rare events.

To evaluate the internal pressures resulting from dominant openings in the building envelope, simultaneous measurements are taken during the wind tunnel test between pairs of pressure taps located on building walls that share the same internal volume. Of particular interest are measurements taken in areas where large pressure differences can occur such as those that are generated at the corners of the floor plate. A single opening (worst case) scenario is typically considered since multiple leakage sources tend to reduce the magnitude of the internal pressure. Using an in-house approach, these data are analyzed to determine the range of internal pressures that may occur at selected opening locations and for a range of probabilities of these openings occurring. Lower probabilities are used in lower wind speed areas (i.e., – non-hurricane/non-typhoon areas), and higher probabilities are used in higher wind speed areas (i.e., – hurricane/typhoon areas) or for buildings that have a large number of operable windows or doors. Using these dominant opening probabilities, internal pressures are determined for the same level of risk as that assumed for the external pressures.

For buildings that use large missile impact resistant glazing everywhere, and do not have operable windows, the potential for breakage due to windborne debris is very low. As a result, the probability of an opening is also very low, and the internal pressures used are at or near the minimum considerations of a nominally sealed building.

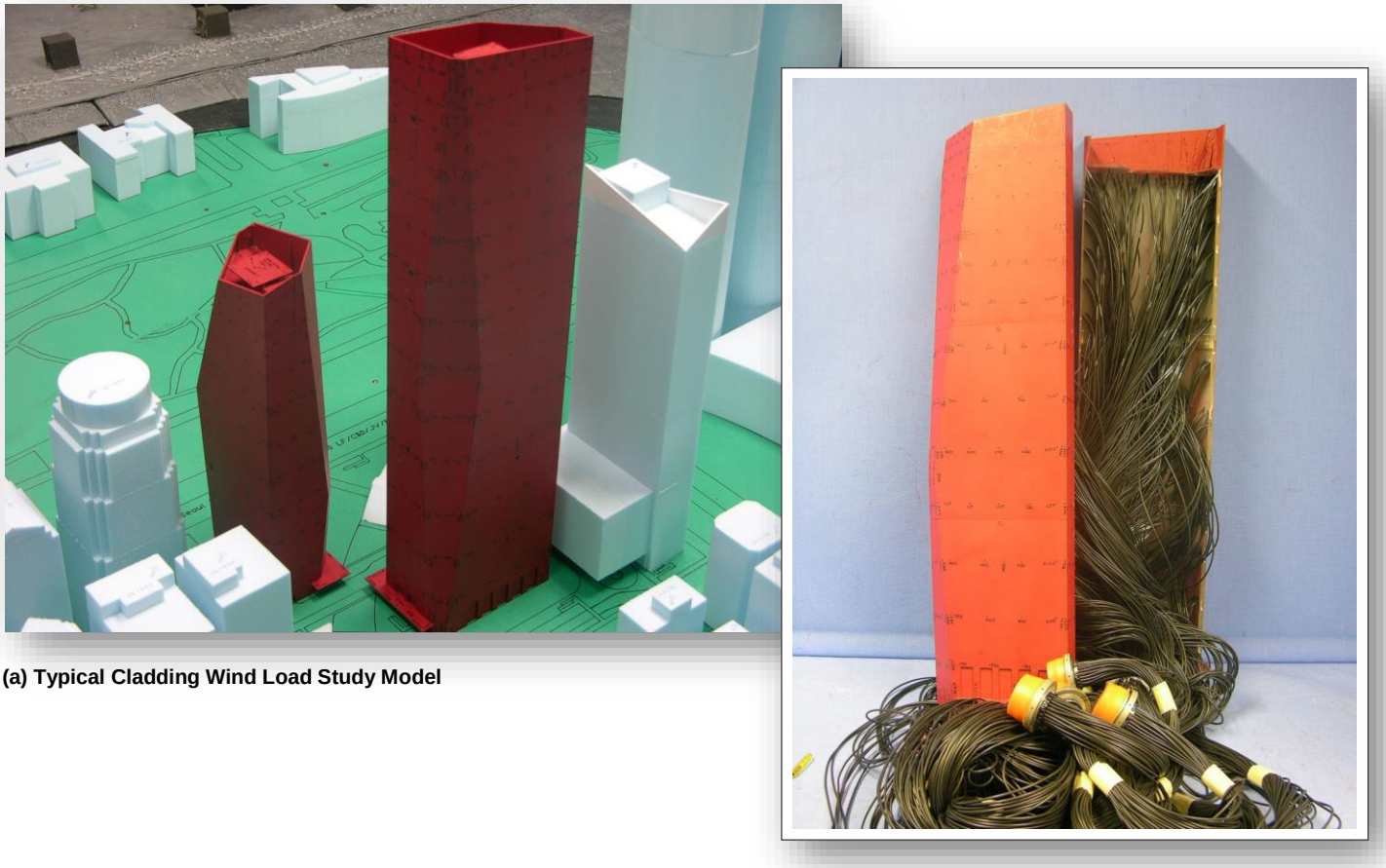
The internal pressure allowances are applied to help reduce the possibility of subsequent facade failures due to pressure increases caused by localized breaches in the facade. Design of the cladding to the provided wind loads will not necessarily prevent breakage due to impact by wind borne debris.

A.1.6 Allowable Stress Design: Comments on the Usage of Recommended Cladding Wind Loads for Glass Design in the United States

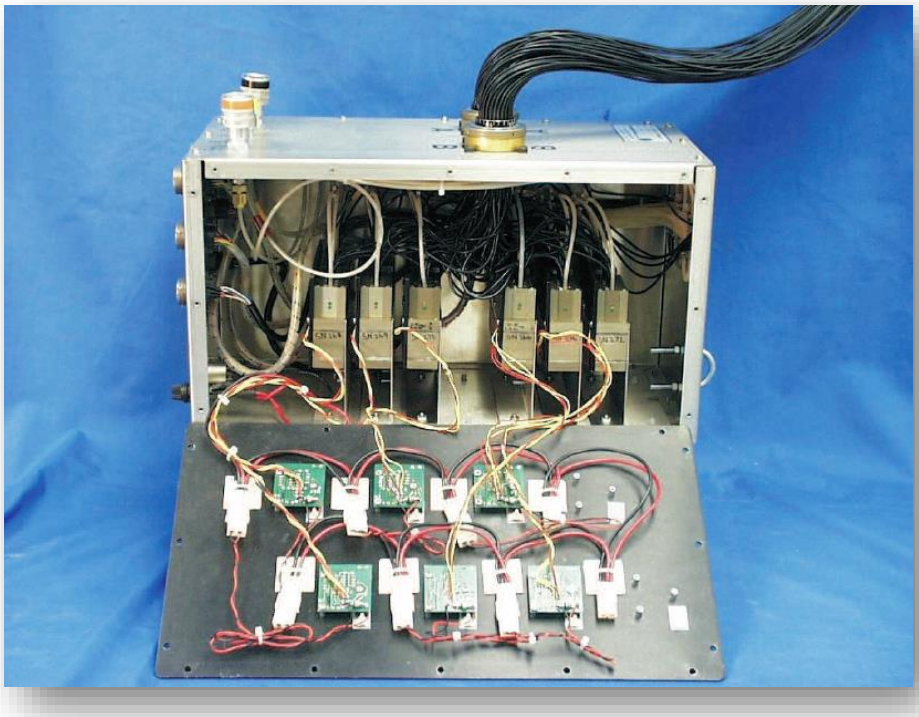
Since the recommended cladding wind loads will apply to the design of glass components, it is appropriate to discuss changes in the American Society for Testing and Materials (ASTM) E-1300 standard for glass design and how the changes relate to the wind loads provided by the American Society of Civil Engineers (ASCE) -7 analytical method and the wind tunnel test method.

Glass is a material for which the strength depends on the duration of the applied load, varying approximately in proportion to $(1/T)^{1/16}$, where T = load duration. Therefore, the glass strength curves in the ASTM E-1300 standard for various types of glass and sizes of panel are provided for a load of specified duration. Prior to 2002, the specified load duration was 60 seconds. In the 2002 edition, ASTM E 1300-02, it was changed to 3 seconds. Therefore, according to the $(1/T)^{1/16}$ rule, the strength of a given glass component in the curves of the 2002 edition is about 20% higher than before.

The wind loads provided by the ASCE-7 analytical method, both prior to 2002 and afterwards, were for a duration in the 1 to 10 second range, or within ± 7% of the 3-second loads. Therefore, the change in the ASTM standard has provided better consistency between the load durations of the two standards. However, unless adjustments are made elsewhere to the safety factors typically applied to the specified wind loads, use of the new ASTM E 1300-2 curves also effectively reduces the safety margin for glass design by about 20% compared with the previous curves. The wind- tunnel derived loads provided in the report are for a duration consistent with that of the ASCE-7 analytical method (i.e., 1 to 10 seconds) and provide the same level of reliability as the analytical method. If the pre-2002 level of reliability of glass design were desired then the loads given in the report (or those derived by a corresponding application of the analytical method) would need to be factored up by 20%, or alternatively the safety factor adjusted by the same percentage.



(a) Typical Cladding Wind Load Study Model



(b) Data Acquisition

Measurement Techniques for the Prediction of Cladding Wind Loads Appendix A - Wind Tunnel Procedures	Figure: 1 Date: December 2, 2016	

APPENDIX B

APPENDIX B: DRAWING LIST FOR MODEL CONSTRUCTION

The drawings and information listed below were received from Gensler and were used to construct the scale model of the proposed Suzhou Zhongnan Center development, Suzhou, China. Should there be any design changes that deviate from this list of drawings, the results may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
20191220	.3dm	20/12/2019

ATTACHMENT B **STRUCTURAL MOVEMENT REPORT**
附录B **结构位移报告**

Thornton Tomasetti

Project

苏州中南中心项目工程主楼
结构竖向变形提资幕墙专业

Prepared For

苏州中南投资建设有限公司

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2020 年 9 月 8 日

目　录

1 工程概况

地块 F 为商业用地，总规划用地 16573.7 平方米，主塔楼总建筑高度 499 米，地上 103 层，地下 6 层。结构高度 487.2 米，顶部为观光层及塔冠。地上总面积约为 36.5 万平方米，主要功能由低至高依次为办公、公寓式酒店、酒店式公寓和观光。该地块设有 6 层地下室，地下总面积为 14.8 万平方米，包括设备用房，卸货区、车库。

2 结构设计规范、标准及规程

- 《建筑结构荷载规范》 GB 50009-2012
- 《混凝土结构设计规范》 GB 50010-2010（2015 年版）
- 《建筑工程抗震设防分类标准》 GB 50223-2008
- 《建筑抗震设计规范》 GB 50011-2010（2016 年版）
- 《高层建筑混凝土结构技术规程》 JGJ 3-2010
- 《钢结构设计标准》 GB 50017-2017
- 《组合结构设计规范》 JGJ138-2016
- 《苏州中南中心风洞试验报告》（RWDI）

3 影响楼板变形的竖向荷载

3.1 结构自重 SW

该部分荷载包括结构钢梁自重、楼板混凝土自重，不包含抹灰、找平、隔墙、设备安装等附加恒荷载。结构自重在幕墙安装前已经完成变形，通常情况下与幕墙专业无关。

该部分荷载由计算机根据结构构件的尺寸自动计算得出。其中：

- 钢筋混凝土容重：25.5kN/m^3
- 钢材容重 78.5kN/m^3

3.2 楼面附加荷载 SDL 及活荷载 LL

	功能	附加恒载 SDL（kPa）					活载 LL（kPa）			
		找平层	架空楼板	建筑面层	吊顶/设备管线	总荷载 SDL	IBC	中国规范	本项目采用值 LL	注
1	典型办公	0.1	0.4	-	0.5	1.0	3.1	3.0	3.0	包含 1.0kPa 隔墙
2	避难层	1.0	-	-	0.5	1.5	-	3.5	3.5	人群聚集
3	酒店	1.0	-	1.0	0.5	2.5	2.0	2.0	2.0	建筑面层指隔墙等效的楼面荷载
	公寓	1.3	-	2.0	0.2	3.5	-	2.0	2.0	建筑面层指隔墙等效的楼面荷载
4	首层大堂	-	-	2.0	0.5	2.5	5.0	3.5	3.5	
5	零售商业	-	-	2.0	0.5	2.5	4.79	3.5	3.5	
6	设备间	0.3	-	0.7	0.5	1.5	6.0	7.0	12.0/7.0	见注 2
7	储藏间	0.3	-	0.7	0.5	1.5	6.0	5.0	5.0	
8	各楼层电梯大堂	-	-	2.0	0.5	2.5	5.0	3.5	3.5	
10	楼梯间	-	-	-	-	7.0	4.79	3.5	3.5	
11	屋顶（不上人）	0.3	-	1.0	0.5	1.8	0.96	0.5	2.0	
12	屋顶（上人）	0.3	-	2.5	0.5	3.3	2.87	2.0	3.0	
13	屋顶（人群聚集）	0.3	-	2.5	0.5	3.3	4.79	3.5	3.5	
14	观光层	-	-	2.0	0.5	2.5	5.0	3.5	3.5	

3.3 幕墙荷载 FAÇADE

ALT 提供的单元幕墙支座反力设计值提资如下：

幕墙反力汇总

办公楼层 （层高4.5m）		Fx （KN）	Fy （KN）	Mz （KN*M）
标准层	钢梁顶部支点	42.13	11.70	7.49
顶层支座反力	钢梁顶部支点	-1.85	11.70	3.09
	钢梁底部支点	31.07		2.17

公寓式酒店、酒店式公寓 （层高4.35m）		Fx （KN）	Fy （KN）	Mz （KN*M）
标准层（两侧非2.8m分隔龙骨部位）	钢梁顶部支点	41.00	13.60	7.91
顶层支座反力	钢梁顶部支点	-0.62	13.60	3.75
	钢梁底部支点	29.20		2.04
标准层（两侧2.8m分隔龙骨部位）	钢梁顶部支点	26.40	19.00	7.96
	钢梁底部支点	31.60		3.16
顶层支座反力	钢梁顶部支点	-4.40	19.00	5.10
	钢梁底部支点	45.20		3.16

酒店楼层 （层高4m）		Fx （KN）	Fy （KN）	Mz （KN*M）
标准层（两侧非2.8m分隔龙骨部位）	钢梁顶部支点	37.70	12.51	7.27
顶层支座反力	钢梁顶部支点	-0.57	12.51	3.44
	钢梁底部支点	26.85		1.88
标准层（两侧2.8m分隔龙骨部位）	钢梁顶部支点	24.28	17.47	7.32
	钢梁底部支点	29.06		2.03
顶层支座反力	钢梁顶部支点	-4.05	17.47	4.49
	钢梁底部支点	41.56		2.91

办公楼层机电层（层高5m）		Fx （KN）	Fy （KN）	Mz （KN*M）
层高5m支座反力	钢梁顶部支点	21.00	13.00	5.74
	钢梁底部支点	27.20		1.90
层高5m支座反力	钢梁顶部支点	14.30	14.30	5.43
	钢梁底部支点	37.80		2.65

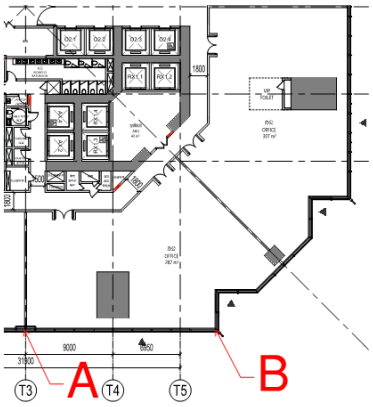
幕墙支座座反力提资汇总

工况	竖向力 kN	跨度 m	层高 m	FAÇADE 荷重 kPa	线荷载[1] kN/m
办公-4.5m	11.70	2.00	4.50	1.3	5.85
酒店-4.0m	17.47	2.8	4.00	1.6	6.24
公寓-4.35m	19.00	2.80	4.35	1.6	6.78
公寓 4.35m	13.60	2.00	4.35	1.6	6.80

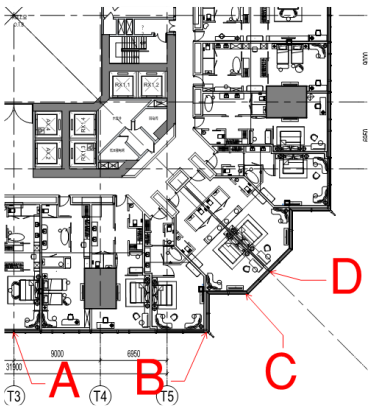
注：幕墙线荷载根据 ALT 单元幕墙支座竖向反力设计值提资反算。

4 节点竖向变形

塔楼幕墙主要由楼层板和外边钢梁支撑，随着荷载施加在楼板上，楼层间会有竖向变形。塔楼的竖向变形主要是由于塔楼结构本身自重，施加在楼板上的附加恒载、活载和施加在外边梁上的幕墙荷载引起。风荷载和地震作用主要导致塔楼整体的侧向变形，对楼板边的竖向位移几乎不产生影响，故本文不再罗列。为了分析塔楼各区楼层的外边梁最大竖向变形，由于塔楼平面布置对称，现取塔楼 1/8 部分的竖向变形进行分析，外边梁典型节点的平面示意图如下：



典型节点编号办公 1-3 区



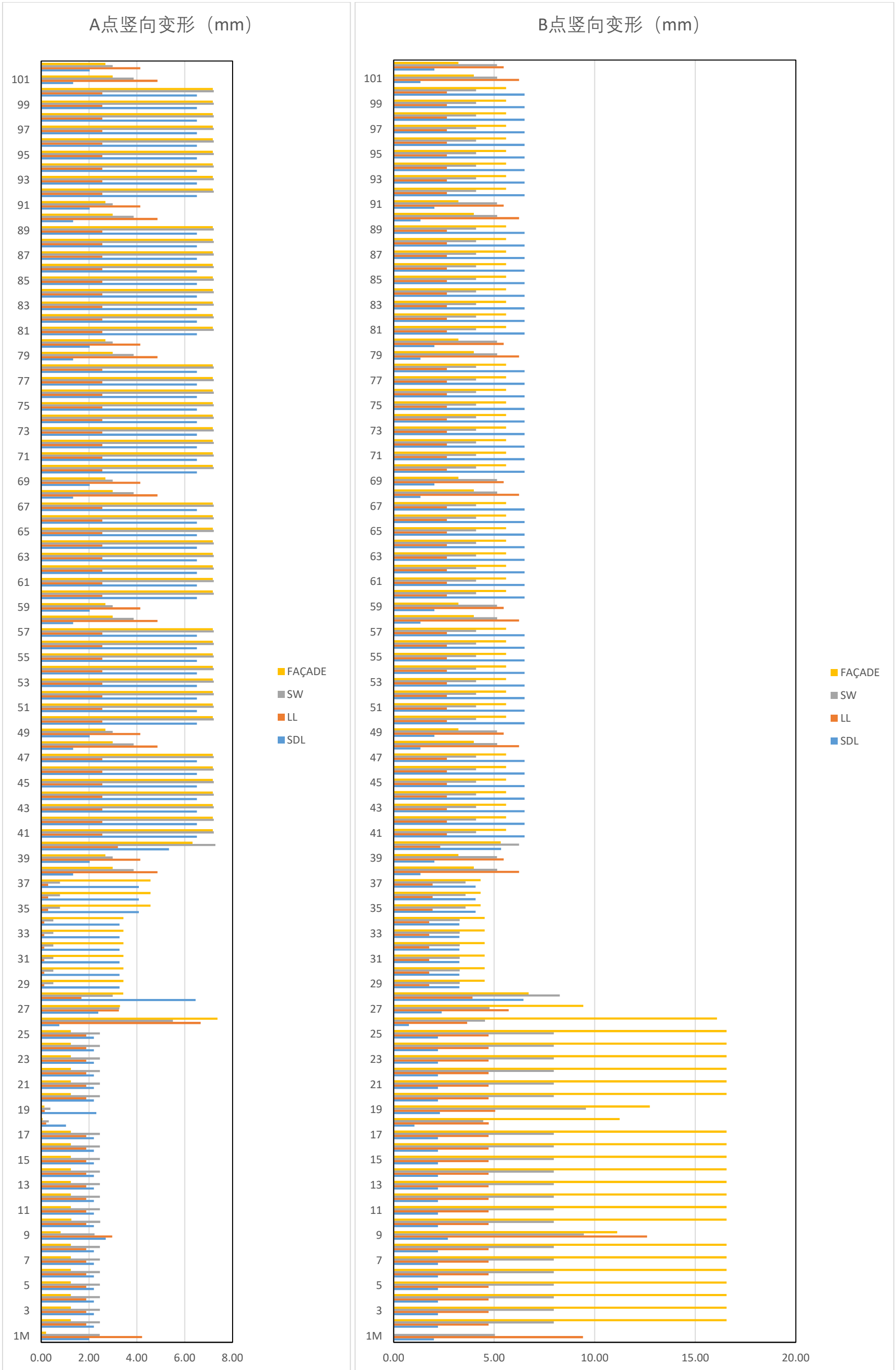
典型节点编号酒店/公寓 4-10 区

塔楼边梁在附加恒载、活载、幕墙荷载和自重下的竖向变形如下：

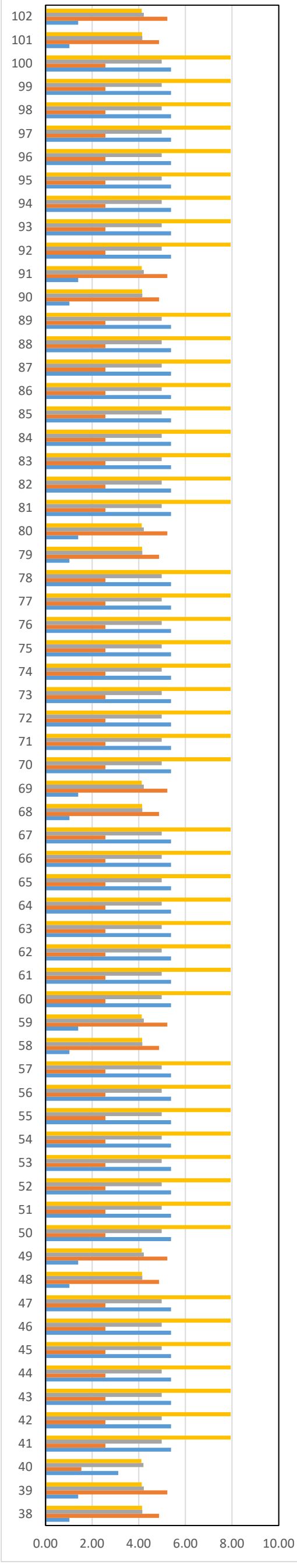
Disp. Up(-)/Down(+)			A (mm)				B (mm)				C (mm)				D (mm)			
Vertical Zone	Level		SDL	LL	SW	FAÇADE	SDL	LL	SW	FAÇADE	SDL	LL	SW	FAÇADE	SDL	LL	SW	FAÇADE
L01M	L01M		0.96	4.22	2.45	0.21	2.01	9.42	5.04	0.02	-	-	-	-	-	-	-	-
Office Typ.	L2-L7		0.86	1.88	2.46	1.25	2.20	4.72	7.97	16.56	-	-	-	-	-	-	-	-
Z1 Refuge/MEP	L9		0.63	2.97	2.23	0.81	2.70	12.61	9.46	11.12	-	-	-	-	-	-	-	-
Office	L10		0.89	1.89	2.47	1.26	2.20	4.72	7.97	16.56	-	-	-	-	-	-	-	-
Office Typ.	L11-L17		0.86	1.88	2.46	1.25	2.20	4.72	7.97	16.56	-	-	-	-	-	-	-	-
Z2 Refuge/MEP	L18	BT Bottom	0.03	0.21	0.32	0.06	1.04	4.73	4.46	11.24	-	-	-	-	-	-	-	-
Office	L19	BT Top	0.06	0.15	0.39	0.14	2.31	5.05	9.57	12.74	-	-	-	-	-	-	-	-
Office Typ.	L20-25		0.86	1.88	2.46	1.25	2.20	4.72	7.97	16.56	-	-	-	-	-	-	-	-
Z3 MEP	L26	BT Bottom	1.44	6.67	5.51	7.37	0.76	3.66	4.54	16.08	-	-	-	-	-	-	-	-
Z3 Refuge	L27	BT Middle	1.26	3.25	3.27	3.30	2.39	5.72	4.78	9.44	-	-	-	-	-	-	-	-
Hotel Lobby	L28	BT Top	1.83	1.69	3.00	3.44	6.46	3.93	8.26	6.72	-	-	-	-	-	-	-	-
Hotel Typ.	L29-L34		0.25	0.13	0.51	3.44	3.27	1.77	3.29	4.53	-	-	-	-	-	-	-	-
Apt Typ.	L35-L37		0.62	0.30	0.79	4.58	4.08	1.94	3.58	4.33	-	-	-	-	-	-	-	-
Z4 Refuge	L38	BT Bottom	1.01	4.86	3.87	2.99	1.34	6.24	5.15	3.99	1.03	4.87	4.15	4.15	1.19	5.62	4.74	4.57
Z4 MEP	L39	BT Middle	1.07	4.14	3.00	2.69	2.03	5.47	5.14	3.22	1.40	5.23	4.22	4.13	1.54	6.12	4.72	4.71
Apt. Lobby	L40	BT Top	5.78	3.21	7.29	6.33	5.35	2.32	6.24	5.33	3.12	1.54	4.20	4.11	3.74	1.80	4.90	4.77
Apt. Typ.	L41-L47		2.07	2.56	7.22	7.18	6.51	2.65	4.10	5.59	5.39	2.57	4.98	7.94	7.21	3.21	5.55	8.60
Refuge/MEP	L48	BT Bottom	1.01	4.86	3.87	2.99	1.34	6.24	5.15	3.99	1.03	4.87	4.15	4.15	1.19	5.62	4.74	4.57
Apt.	L49	BT Top	1.07	4.14	3.00	2.69	2.03	5.47	5.14	3.22	1.40	5.23	4.22	4.13	1.54	6.12	4.72	4.71
Apt. Typ.	L50-L57		2.07	2.56	7.22	7.18	6.51	2.65	4.10	5.59	5.39	2.57	4.98	7.94	7.21	3.21	5.55	8.60
Refuge/MEP	L58	BT Bottom	1.01	4.86	3.87	2.99	1.34	6.24	5.15	3.99	1.03	4.87	4.15	4.15	1.19	5.62	4.74	4.57
Apt.	L59	BT Top	1.07	4.14	3.00	2.69	2.03	5.47	5.14	3.22	1.40	5.23	4.22	4.13	1.54	6.12	4.72	4.71
Apt. Typ.	L60-L67		2.07	2.56	7.22	7.18	6.51	2.65	4.10	5.59	5.39	2.57	4.98	7.94	7.21	3.21	5.55	8.60
Refuge/MEP	L68	BT Bottom	1.01	4.86	3.87	2.99	1.34	6.24	5.15	3.99	1.03	4.87	4.15	4.15	1.19	5.62	4.74	4.57
Apt.	L69	BT Top	1.07	4.14	3.00	2.69	2.03	5.47	5.14	3.22	1.40	5.23	4.22	4.13	1.54	6.12	4.72	4.71
Apt. Typ.	L70-L78		2.07	2.56	7.22	7.18	6.51	2.65	4.10	5.59	5.39	2.57	4.98	7.94	7.21	3.21	5.55	8.60
Refuge/MEP	L79	BT Bottom	1.01	4.86	3.87	2.99	1.34	6.24	5.15	3.99	1.03	4.87	4.15	4.15	1.19	5.62	4.74	4.57
Apt.	L80	BT Top	1.07	4.14	3.00	2.69	2.03	5.47	5.14	3.22	1.40	5.23	4.22	4.13	1.54	6.12	4.72	4.71
Apt. Typ.	L81-L89		2.07	2.56	7.22	7.18	6.51	2.65	4.10	5.59	5.39	2.57	4.98	7.94	7.21	3.21	5.55	8.60
Refuge/MEP	L90	BT Bottom	1.01	4.86	3.87	2.99	1.34	6.24	5.15	3.99	1.03	4.87	4.15	4.15	1.19	5.62	4.74	4.57
Apt.	L91	BT Top	1.07	4.14	3.00	2.69	2.03	5.47	5.14	3.22	1.40	5.23	4.22	4.13	1.54	6.12	4.72	4.71
Apt. Typ.	L92-L100		2.07	2.56	7.22	7.18	6.51	2.65	4.10	5.59	5.39	2.57	4.98	7.94	7.21	3.21	5.55	8.60
Refuge/MEP	L101	BT Bottom	1.01	4.86	3.87	2.99	1.34	6.24	5.15	3.99	1.03	4.87	4.15	4.15	1.19	5.62	4.74	4.57
OB	L102	BT Top	1.07	4.14	3.00	2.69	2.03	5.47	5.14	3.22	1.40	5.23	4.22	4.13	1.54	6.12	4.72	4.71

注：表格数据为结构扩初阶段模型分析。最终幕墙必须保留适当冗余应对施工缺陷、施工误差和施工图阶段的荷载变化。

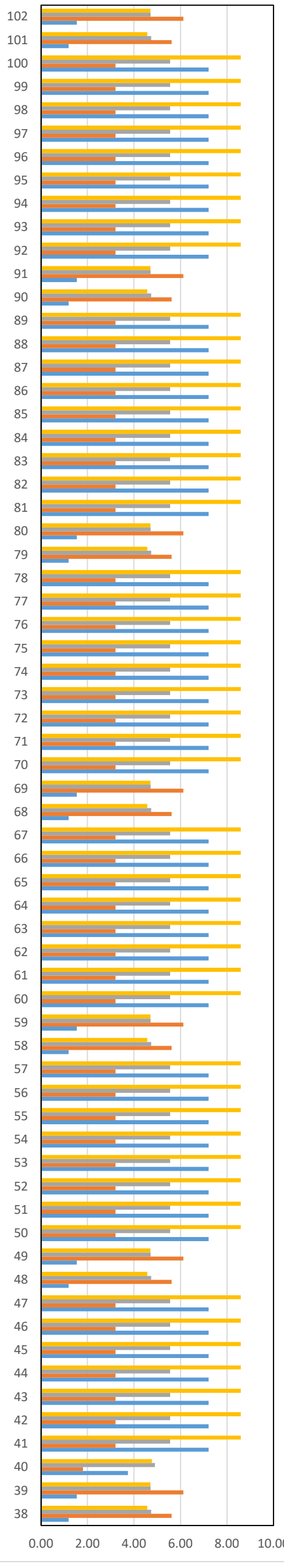
外边梁在附加恒载、活载、幕墙荷载和自重下的竖向变形如下图所示



C点竖向变形（mm）



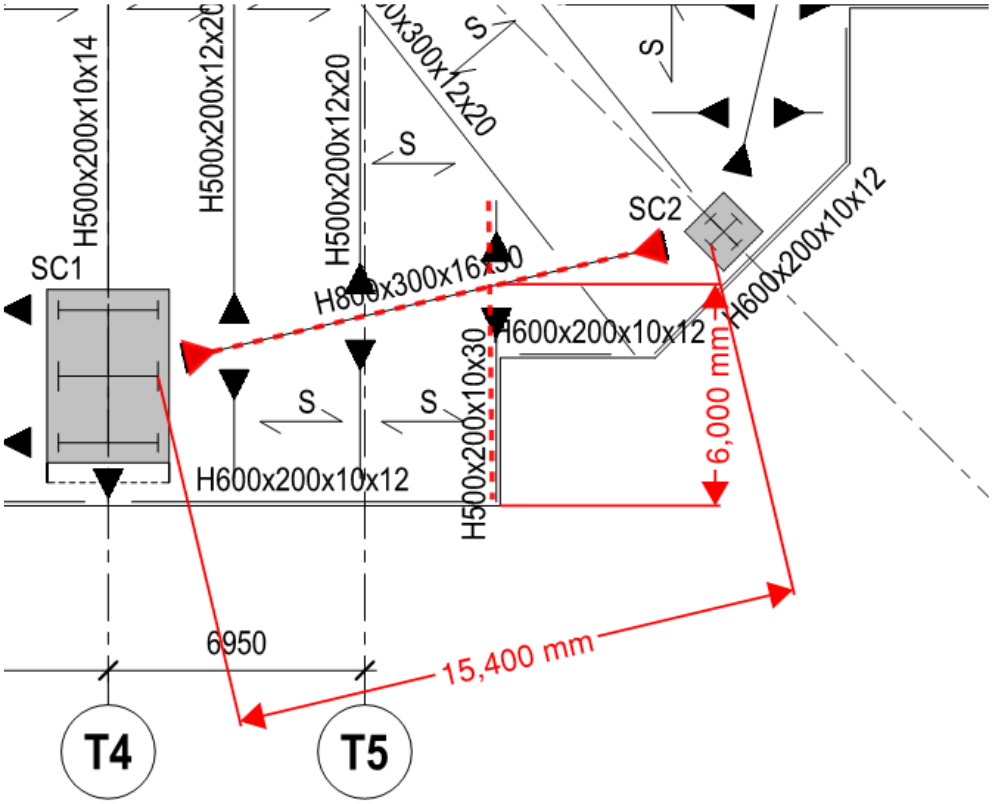
D点竖向变形（mm）



说明：

1. 1-3 区 B 点的变形较大，是由于此处悬挑较长，且支撑悬挑的主梁跨度也很大造成的。目前已对这两根梁进行了加高加刚，挠度有所减小但幕墙节点设计时仍需特别注意此处。

   下图中 15.4m 跨主梁由 800mm 增至 1000mm；6m 悬挑梁由 500mm 增至 800mm：



2. 上述的变形只考虑了钢梁的弹性变形。如考虑混凝土楼板的刚性作用，可将上述变形值乘以 0.80.
3. 以上是各层相对变形的影响。对于 500m 的超高层，巨柱的压缩变形以及长期徐变的收缩变形会对幕墙产生累加作用，不可以忽略。通常弹性压缩变形在建筑物封顶时完成80%左右，而混凝土徐变则会长期存在，在建筑物建成 10-15 年左右基本稳定，后期影响有限。收缩徐变的影响见下页。

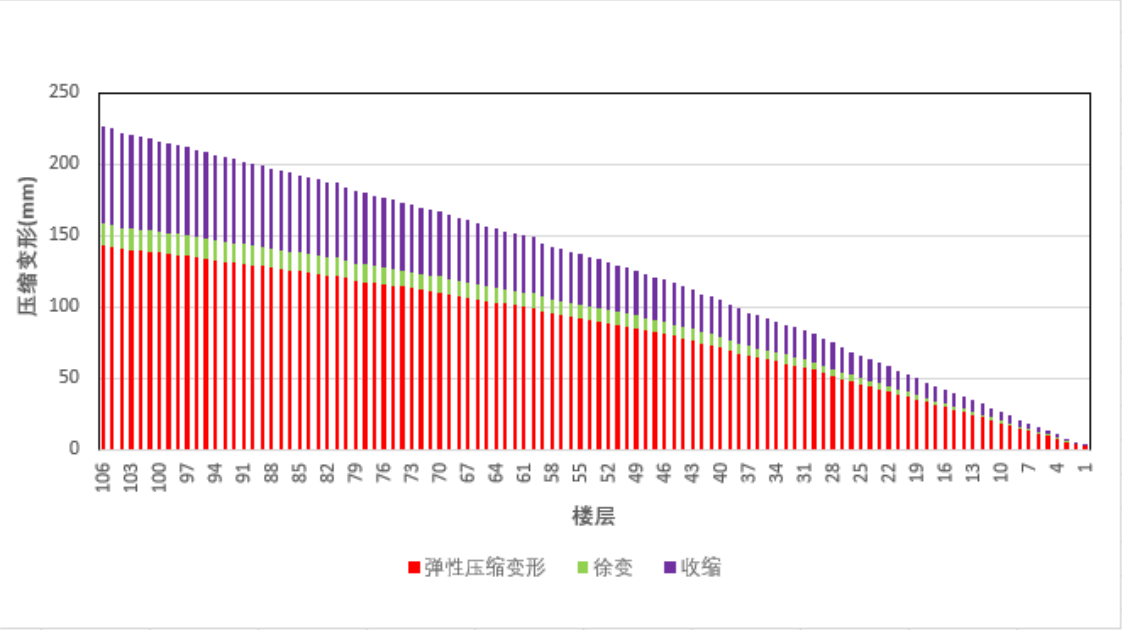
5 长期荷载效应下竖向构件压缩变形

长期柱压缩变形定义为楼板安装后10年期间的压缩变形，包括弹性变形、非线性徐变和收缩变形。

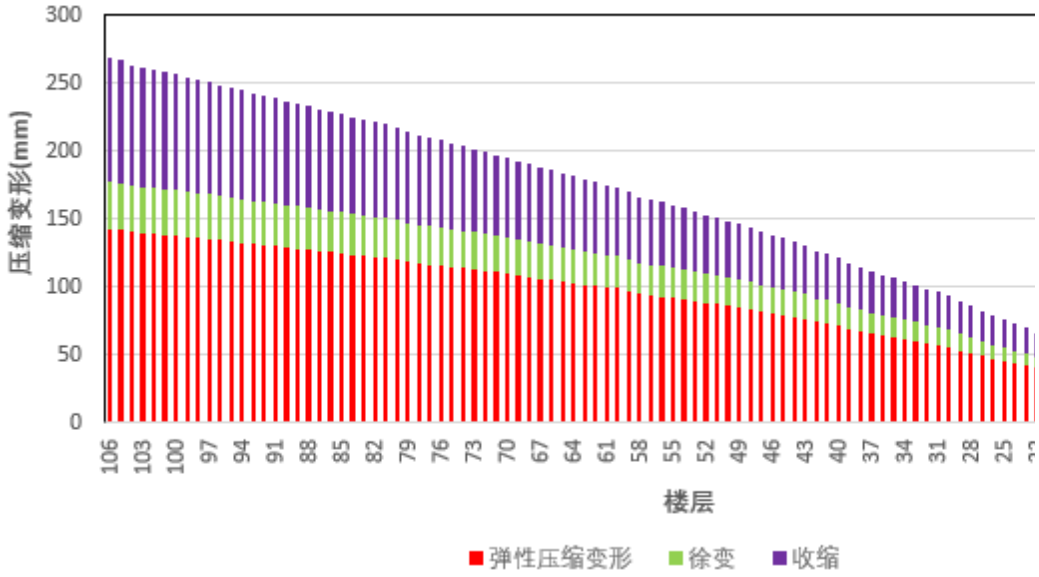
由于塔楼平面结构对称布置，选择任意一根巨柱柱Column 1的长期压缩变形分析。研究塔楼长期收缩徐变对幕墙的影响。

柱压缩变形由三部分组成：（考虑施工工序的）弹性压缩变形、徐变和收缩。每部分压缩变形在总压缩变形所占比例主要由应力比、配筋率、体积-表面积之比v/s或构件理论厚度h等因素决定。通常情况下，考虑了施工工序的弹性压缩变形会比较大，其次为徐变和收缩。如果结构构件的体积-表面积之比比较低时，例如墙体，收缩变形可能比徐变更大。

下图表示了伸臂桁架锁定后（封顶）、施工开始12年后巨柱的压缩变形。从图中可以看出总压缩变形及弹性压缩变形、徐变与收缩变形占总压缩变形的相对比例。

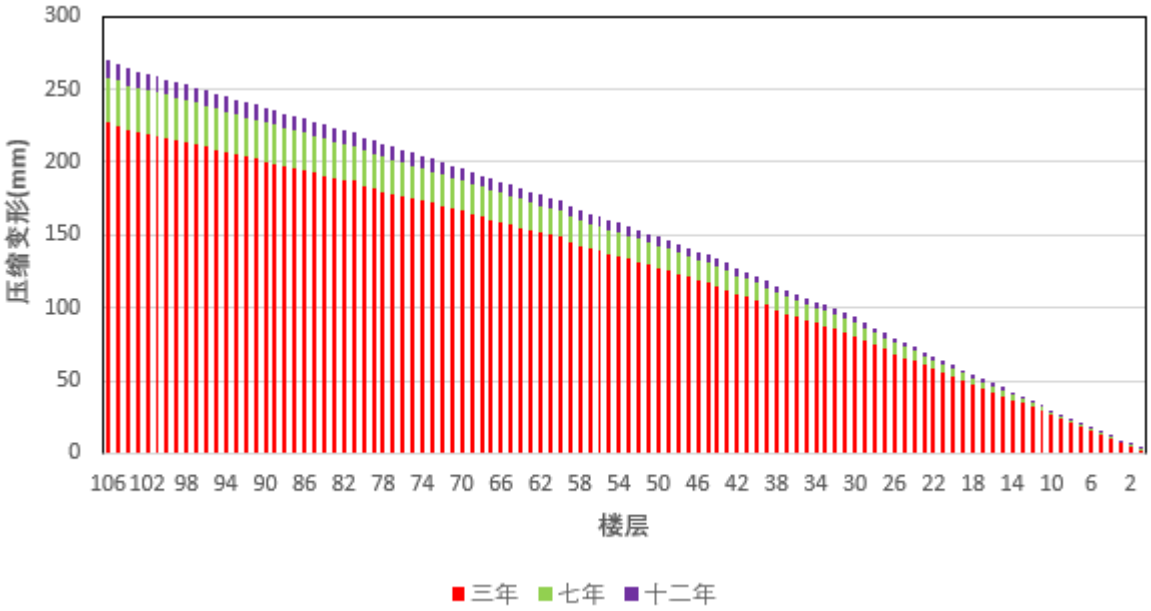


(考虑长期荷载效应的) 伸臂桁架锁定后–巨柱Column1压缩变形



(考虑长期荷载效应的)施工开始12年后–巨柱Column 1压缩变形

下图显示巨柱在施工开始后12年期间包括弹性、徐变和收缩各阶段的总压缩变形。各阶段又细分成3个区段。从图中可以看出，绝大部分的压缩变形在施工开始3年内完成。



(考虑长期荷载效应的)巨柱Column1在12年期间的总压缩变形

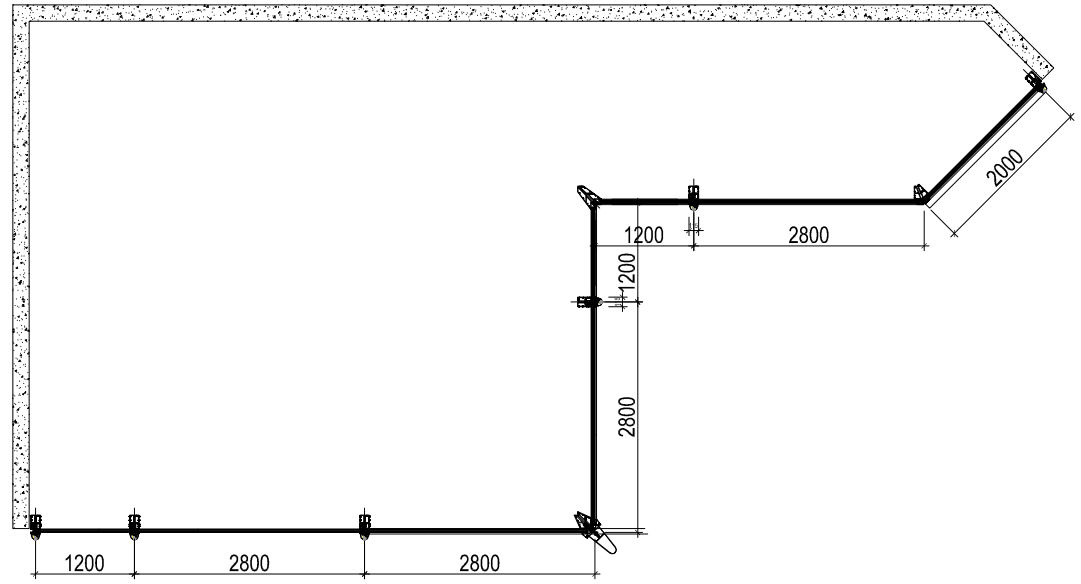
具体的数据统计见下表：

楼层	柱 Column 1(毫米)				
	封顶时变形量绝对值(mm)	单楼层压缩量 D1 (mm)	12 年变形量绝对值(mm)	单楼层压缩量 D2 (mm)	单楼层压缩量总计 D3 (mm)
105	238	2.0	267	0.0	2.0
100	228	1.6	257	0.4	2.0
95	220	1.8	247	0.2	2.0
90	211	1.6	237	0.2	1.8
85	203	2.0	228	0.2	2.2
80	193	1.8	217	0.4	2.2
75	184	1.8	206	0.2	2.0
70	175	2.2	196	0.2	2.4
65	164	1.6	184	0.4	2.0
60	156	2.6	174	0.2	2.8
55	143	2.0	160	0.2	2.2
50	133	2.2	149	0.4	2.6
45	122	2.6	136	0.2	2.8
40	109	2.6	122	0.4	3.0
35	96	2.4	107	0.4	2.8
30	84	3.2	93	0.2	3.4
25	68	2.6	76	0.4	3.0
20	55	2.8	61	0.4	3.2
15	41	2.8	45	0.2	3.0
10	27	2.6	30	0.4	3.0
5	14	2.8	15	0.2	3.0

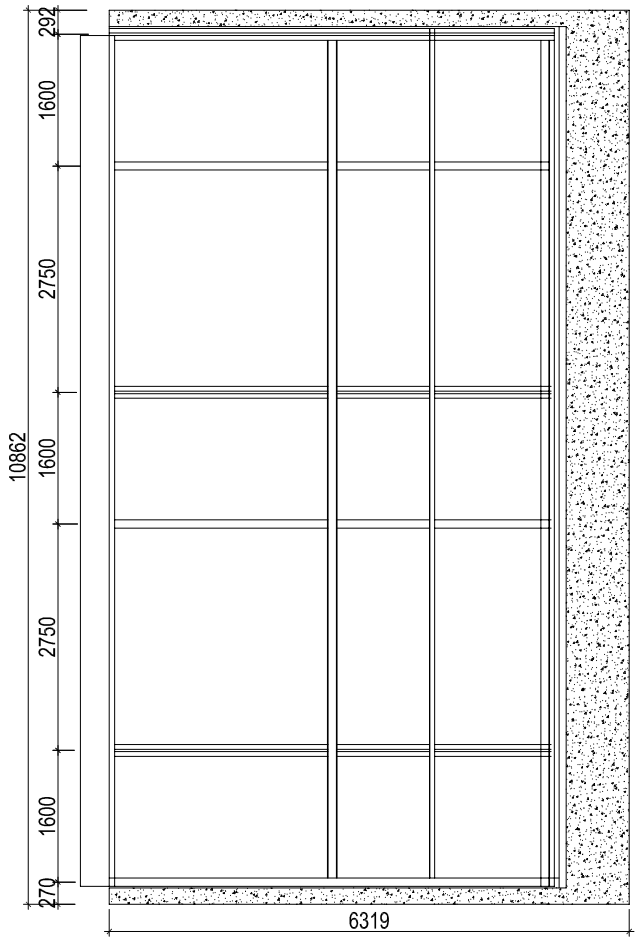
从上表看出，500m超高层塔楼的竖向压缩变形对幕墙的影响主要有：D1（封顶时的压缩变形量），D2（此后至12年的压缩变形量）以及累计值D1+D2=D3。如果幕墙在结构封顶、伸臂桁架锁定后再开始施工，只需考虑D2值。如果幕墙在结构尚未完成已经开始施工，则同时施工的部分需要考虑D1+D2=D3，即每层约2-3mm的变形量。但这些变形量是多年累积产生的，可以不与SDL和façade荷载的施工工况叠加。

上述分析是根据假定的施工进度、材料特性及环境条件。在施工阶段，施工图设计单位和施工安装单位应根据实际情况复核，并留有一定余量。

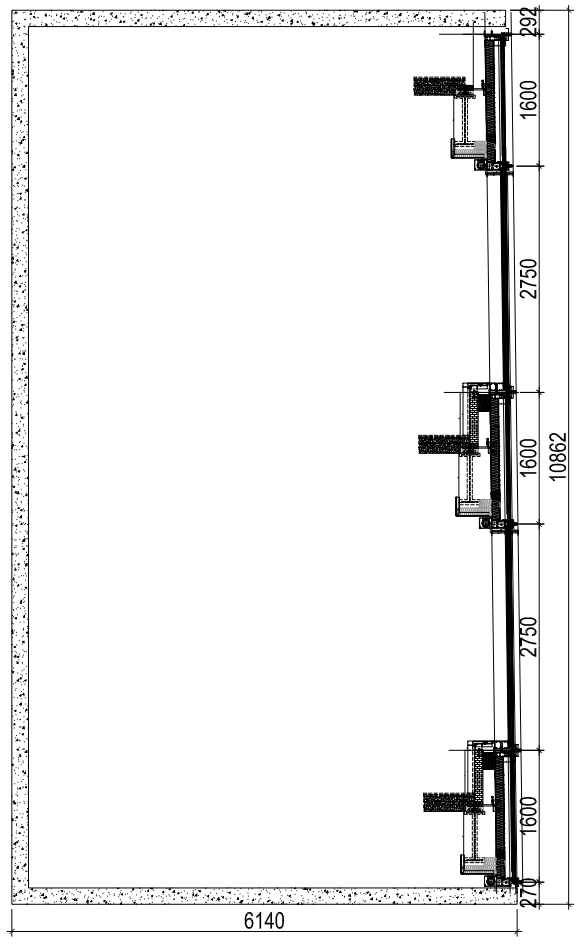
ATTACHMENT C PMU SCOPE
附录 C 幕墙性能试验范围



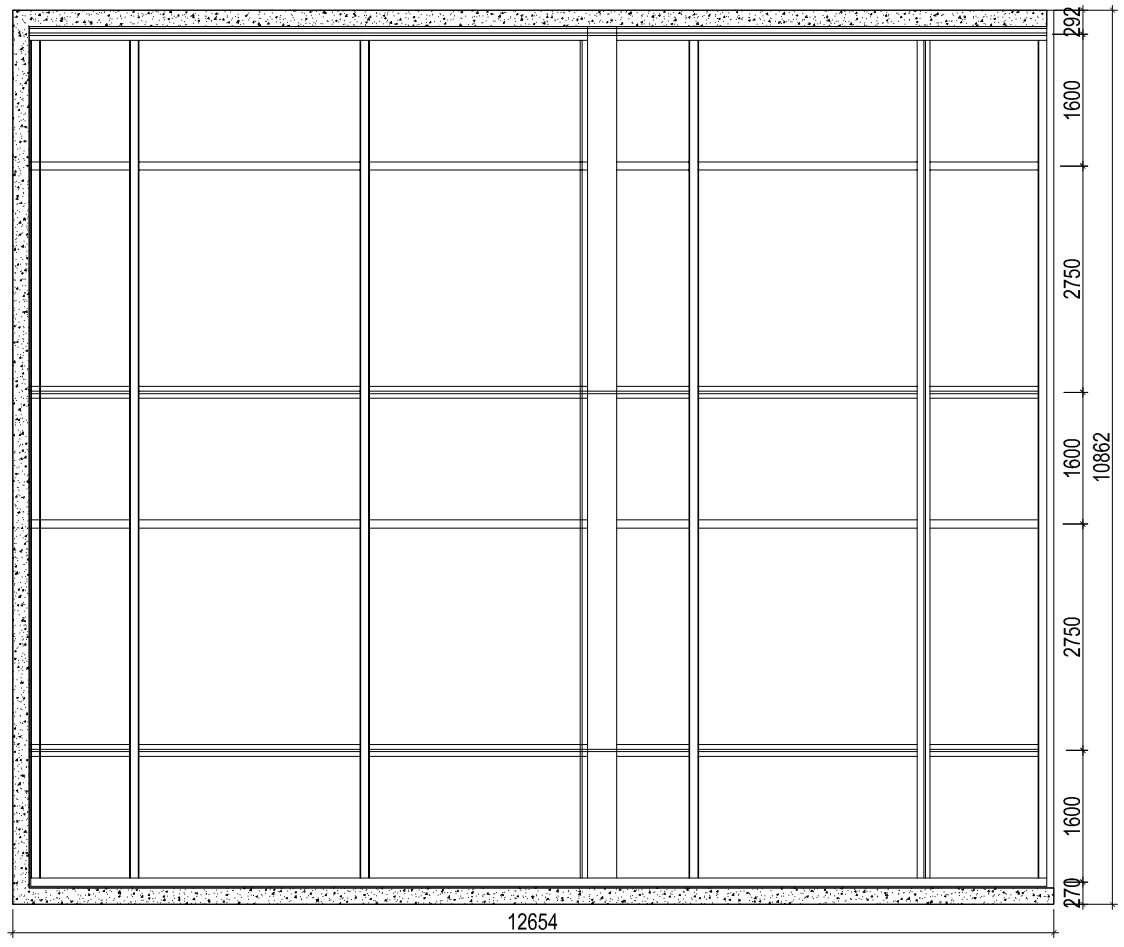
01 平面图



02 立面图



03 剖面图



04 立面图

11	幕墙方案设计文本 FACADE SCHEMATIC DESIGN SUBMISSION	2020.10.15
10	初步设计文本 - 地上部分 DESIGN DEVELOPMENT SUBMISSION - ABOVE GROUND	2020.09.30
09	初步设计阶段图纸(9-10区) IN-PROGRESS DD SUBMISSION (ZONE 9+10)	2020.09.10
08	初步设计阶段图纸(4-6区) IN-PROGRESS DD SUBMISSION (ZONE 4+6)	2020.08.31
07	初步设计阶段图纸(1-4区) IN-PROGRESS DD SUBMISSION (ZONE 1+4)	2020.07.31
06	初步设计阶段图纸(1-2区) IN-PROGRESS DD SUBMISSION (ZONE 1+2)	2020.07.27
05	方案设计报审文件更新 SCHEMATIC DESIGN SUBMISSION	2020.04.18
04	初步设计文本 DESIGN DEVELOPMENT SUBMISSION	2020.03.27
03	50%初步设计文本地下室部分 50% DESIGN DEVELOPMENT SUBMISSION (BASEMENT RE-ISSUE)	2020.02.22
02	50% 初步设计 50% DESIGN DEVELOPMENT SUBMISSION	2020.01.31
01	方案设计报审文件 SCHEMATIC DESIGN SUBMISSION	2020.01.15
序号 NO.	事项内容 DESCRIPTION	日期 DATE

章章 SEAL

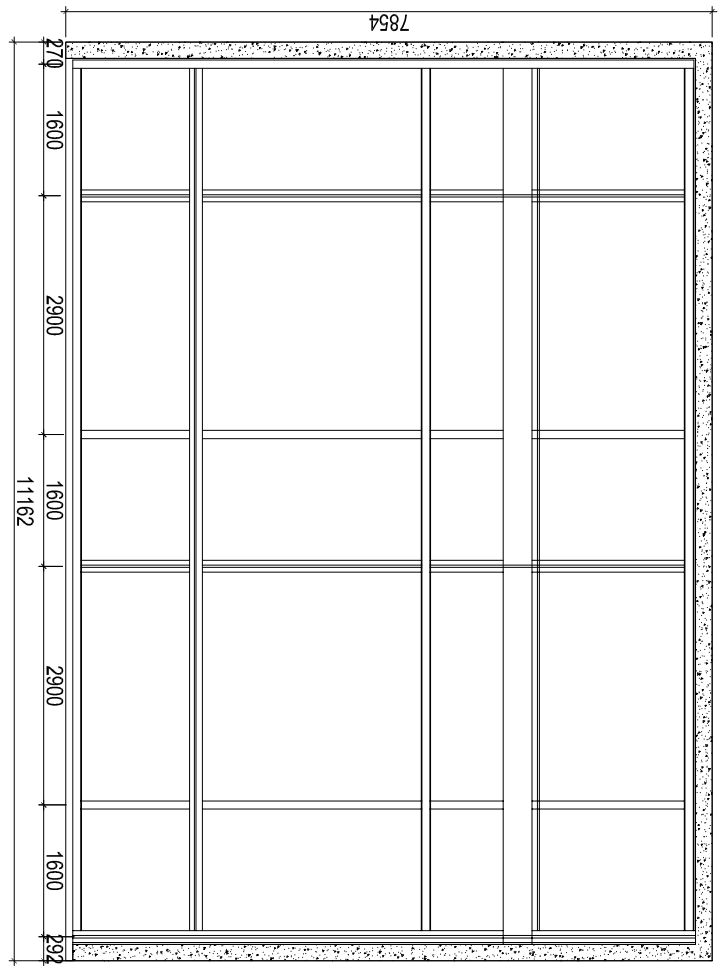
建设单位 CLIENT
苏州中南中心投资建设有限公司

项目名称 PROJECT 中南中心超高层商业楼宇项目（DK20110136地块）超高层
SUZHOU ZHONGNAN CENTER

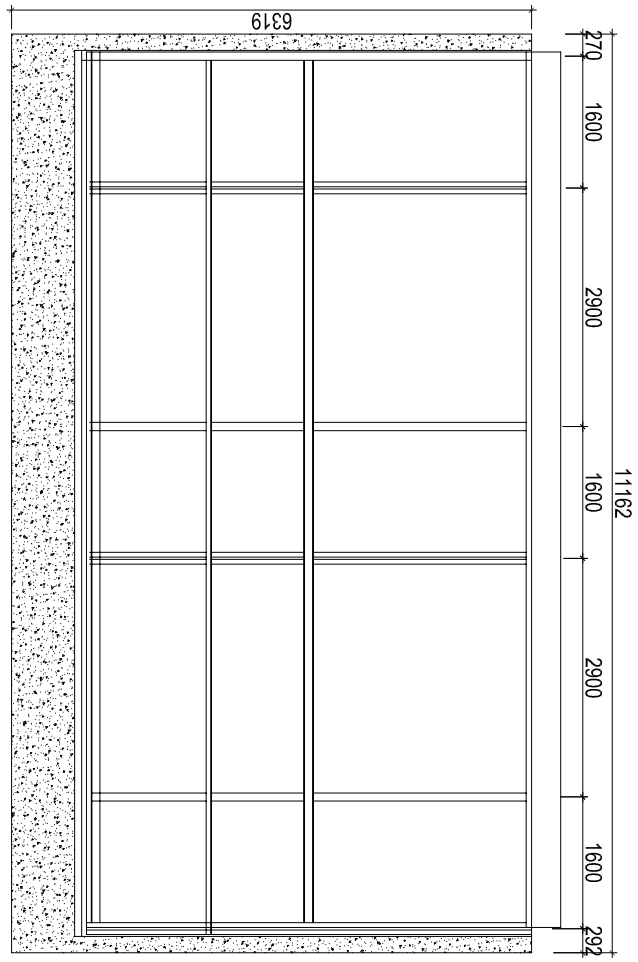
子项名称 SUB PROJECT

图名 DRAWING TITLE

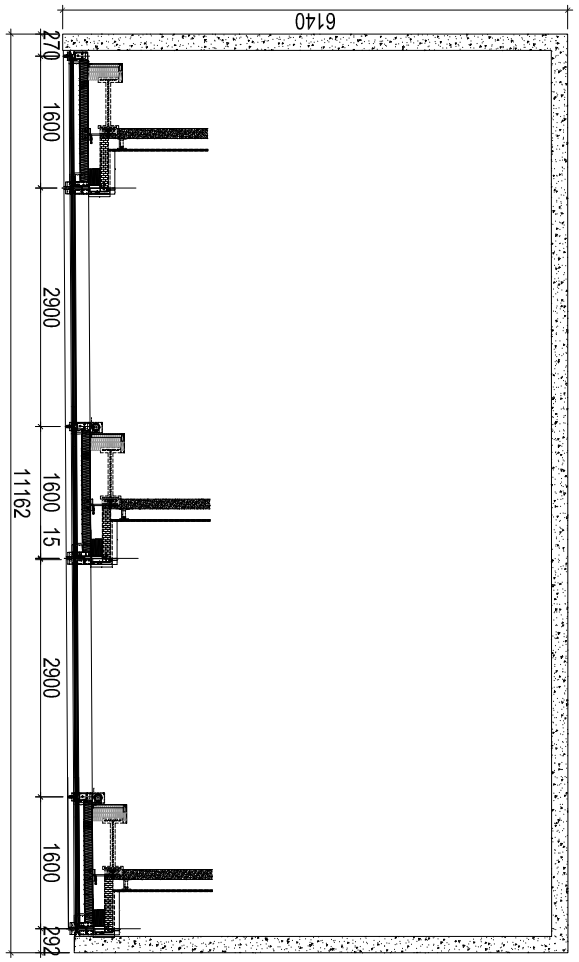
工程编号 JOB NO.	C-201955007	阶段 STATUS	幕墙方案设计
比例 SCALE		专业 DISCIPLINE	建筑
日期 DATE	2020.10.15	图号 DRAWING NO.	PMU-01



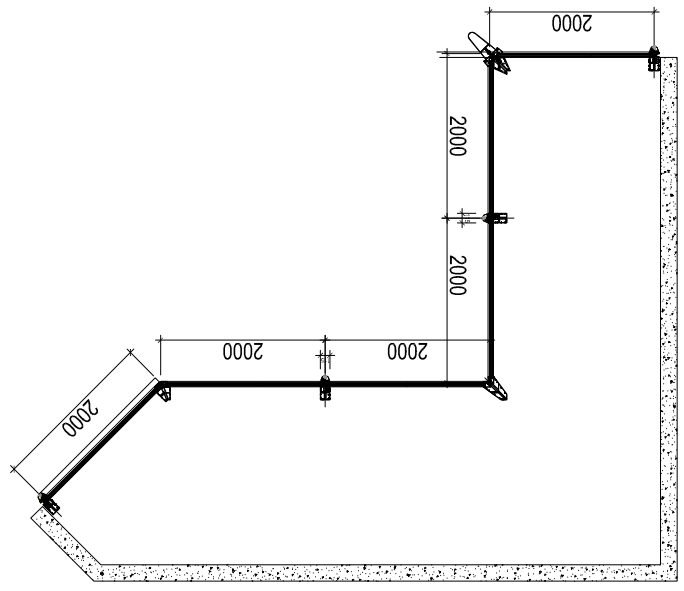
02 立面图



03 剖面图



04 立面图



01 平面图

序号	修改内容 DESCRIPTION	日期 DATE
11	电动车充电桩位置 ELECTRIC VEHICLE CHARGING PILE LOCATION	2020.05.15
10	取消部分卫生间 CANCEL PART OF TOILET	2020.05.20
09	卫生间布置调整 TOILET LAYOUT ADJUSTMENT	2020.06.01
08	卫生间布置调整+细节 TOILET LAYOUT ADJUSTMENT+DETAIL	2020.06.30
07	卫生间布置调整+细节 TOILET LAYOUT ADJUSTMENT+DETAIL	2020.07.31
06	卫生间布置调整+细节 TOILET LAYOUT ADJUSTMENT+DETAIL	2020.07.31
05	无障碍坡道位置调整 WHEELCHAIR RAMP ADJUSTMENT	2020.08.19
04	取消部分卫生间 DESIGN DEVELOPMENT SUBMISSION	2020.09.27
03	为满足消防规范调整卫生间布局 ADJUSTMENT TOILET LAYOUT TO MEET FIRE CODE	2020.10.22
02	为满足消防规范调整卫生间布局 ADJUSTMENT TOILET LAYOUT TO MEET FIRE CODE	2020.11.9
01	方案设计完成 SCHEMATIC DESIGN SUBMISSION	2020.11.15

图章 SEAL

建筑单位 OWNER

华建集团 ARCPLUS

华东建筑设计研究总院

EDADI 华东建筑设计研究院有限公司

资质证书编号 A131004031

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STRUCTURAL CONSULTANT
msp

智能化设计咨询
INTELLIGENT CONSULTANT

幕墙设计咨询
FACADE CONSULTANT
ABUNDANCE 安邦

给排水设计咨询
PLUMBING CONSULTANT

暖通设计咨询
HVAC CONSULTANT

电气设计咨询
ELECTRICAL CONSULTANT

室内设计咨询
INTERIOR DESIGN CONSULTANT

景观设计咨询
LANDSCAPE CONSULTANT

建设单位
CLIENT
苏州市商务中心投资建设有限公司

项目名称
PROJECT
中南中心超高层甲级写字楼项目 (JXA2011036地块) 超高层
SUZHOU ZHONGNAN CENTER

子项名称
SUB PROJECT

图号
DRAWING NO.

工程编号 JOB NO. C-2019S5007
比例 SCALE
专业 DISCIPLINE 建筑
日期 DATE 2020.10.15
图号 DRAWING NO. PMU-02

Tommy 2020/12/15 15:27:00 M:\Project Folder\P19.86.046 - Suzhou Zhongnan Center\PMU scope.dwg

ATTACHMENT D **DESIGN DEVELOPMENT REQUIREMENT**
附录 D **设计深度要求**

设计深度要求

1. 幕墙施工图纸内容要求

幕墙施工图纸一般应包括封面、目录、设计说明、材料明细表、立面图、平面图、局部大样图、节点图、埋件图等。

各部分图纸内容应统一、完善，立面图、平面图与大样图、节点图等图纸的表述要一致，前后对应。

2. 幕墙施工图纸编号要求

幕墙施工图除封面外，应按照图纸内容的分类进行编号，各类别编号应统一连续。

3. 封面和目录设计深度要求

1、封面

应包括工程名称、出图日期、公司名称、主要内容等。

2、目录

应按全部图纸的种类划分大项，在大项下按图纸编号、名称等顺序排列，图纸页数应连续编码。

4. 设计说明设计深度要求

包括幕墙工程概况、设计依据、主要幕墙形式说明、幕墙结构及构造要点说明、物理性能、建筑设计、材料选择、加工与施工要求及一般说明九个部分。

1、幕墙工程概况

应包括幕墙工程名称、建设地点、业主和建筑师及建筑总承包单位和建设监理单位全称、建筑物总高度、层数、标准层高、总面积、主体结构形式、地面粗糙类别、建筑物耐火等级、抗震设计烈度、幕墙工程概述等。

2、设计依据

应列举幕墙工程所参照和引用的国家及地方颁布的规范及规程、法令以及行业标准文件包括工程招标和答疑文件等。

3、主要幕墙形式说明

应对幕墙工程所采用的主要幕墙形式进行简要说明，包括但不限于对主要幕墙形式的分布部位和位置、结构体系、龙骨和面板材质与规格等、节点做法、主要特点等的简要说明。

4、幕墙结构及构造要点说明

应对幕墙工程的主体结构体系、荷载组合、传力途径、预埋件等进行详细说明，应表明工程设计构造形式和连接节点具有的安全性、先进性和经济性，以及立面分格和幕墙的构造厚度等。

5、物理性能

应明确幕墙工程的设计风压变形性能、空气渗透性能、雨水渗漏性能、平面内变形性能；隔声性能、保温性能、耐撞击性能以及光学性能等。

6、建筑设计

主要包括幕墙工程的防雷构造设计、防火构造设计、抗震设计、耐腐蚀设计、绿色环保和节能设计等。

7、材料选择

表明用于幕墙工程的主要材料的使用部位、材质、规格、产地要求（如有）、主要性能指标等。

一般应包括铝合金型材、钢制件、玻璃、金属板、石材及其它板材、胶类、密封胶条、五金配件及其它附件等，应对幕墙工程所用的主要材料进行有针对性的说明和描述。

其中特别强调以下内容：

1）铝合金型材、钢制件、金属板、石材等需特别明确材质和表面处理要求。

2）玻璃需特别明确原片、钢化、夹胶、中空层、镀膜等主要性能指标，对原片颜色、玻璃均质处理、夹胶胶片、中空层的构造和填充、镀膜的类型及镀膜面的位置等要重点予以说明。

3）胶类包括硅酮耐候胶和结构胶等，需特别明确区分中性或酸性、单组份或双组分等要求。

4）密封胶条需特别明确材质，区分三元乙丙、氯丁橡胶、硅橡胶等具体要求。

5）五金配件需特别明确材质、开启方式、规格等指标，如应区分不锈钢 304 和 316 的材质要求，说明开启五金的铰链、风撑、多点锁系统具体配置、地弹簧的承重要求等。

8、加工及施工要求

应说明对构件加工精度的要求、与土建设计施工的配合要求、与电气设计施工的配合要求、对幕墙施工的要求包括施工精度要求等。

9、一般说明

包括对清洗设备（如有）及设计资料的一般说明。

5. 材料明细表设计深度要求

材料明细表应表示出该工程所用的所有材料，包括铝型材、玻璃、铝板、石材、钢板、钢型材、钢加工件、密封胶、胶条、保温防火材料、五金件、螺栓螺钉及其他辅材等。

铝型材须说明各种材料所有的部位，表面处理、颜色要求、材质要求、线密度和断面形式等。

玻璃须说明各种材料所有的部位和主要说明，比如玻璃的厚度、颜色、镀膜处理等。

铝板、石材、钢板、钢型材及钢加工件等须说明各种材料所有的部位、表面处理、颜色、规格要求等。

其他幕墙材料须说明所有的部位和规格、参数等。

6. 平面图设计深度要求

幕墙工程平面图应表示出主体结构、平面分格、立柱位置、面板等设计内容。

1、结构平面

幕墙平面图必须以建筑结构平面图为基准进行绘制，应准确表示出幕墙附近的主体结构，包括结构柱、构造柱、剪力墙、填充墙、主体结构边梁，其中柱、剪力墙及填充墙应区分明确，首层的有橱窗位置应将橱窗内墙和门表示清楚。应绘制足够的墙身大样图，在墙身大样图上应准确表示出主体结构边梁、填充墙及圈梁，并作控制性标注。

2、不同幕墙总类的表达

幕墙平面图应准确表示出立柱的位置及幕墙面板，面板的接缝应予以定位表示，全玻幕墙应表示出玻璃肋。可以看到的装饰面应用图例填充，有装饰条的幕墙应表示清楚装饰条距面板的距离，雨篷应在平面图上表示出来，有吊顶时，应将吊顶平面图表示清楚，如有灯具也应表示。

3、标注

幕墙平面图中应标出面板的分格、幕墙厚度尺寸及幕墙种类的分界线，尺寸标注必须跟相邻轴线有关系，所有的标注必须字高大小一样，字高 2.5㎜，等比例缩放。索引大样时应明确标注大样的范围和索引号。

4、幕墙平面图绘制比例应合理，不能超过 1：300，必要时应分段绘制，比例要求必须遵循建筑制图标准。

5、幕墙平面图剖切位置应在窗高中部，图中应表示出开启扇及门的位置，表示出门窗编号及幕墙编号。

6、幕墙平面图中应将室内部分表达完整，特别是与幕墙紧邻、相关的隔墙以及临近幕墙的房间名称。

7、图纸图框上应有图纸名称、图纸编号、比例、索引位置、页码等，必要时可以表示设计要求等。

7. 立面图设计深度要求

幕墙立面图应完善表达出建筑幕墙立面设计效果、幕墙材料及所在位置、分格等。

1、幕墙立面图中应准确表示出立面分格、凹凸转折关系及窗洞位置。有凹凸或转折关系时，应采用粗线明确表示。遮挡部分必须采用展开图表示，斜面幕墙或弧面幕墙可以采用展开图表示等。

2、幕墙立面图中应对不同材料和结构形式的幕墙进行不同的填充表示，图中幕墙工程材料超过一种时，应用不同的填充图案表示，并有图例说明。

3、立面图的竖向标注应包括楼层标高标注、楼层号标注、竖向板块分格尺寸标注、层高标注、建筑总高标注等，需要时应对局部标高进行标注，尺寸标注必须跟相应的楼层标高有关系，所有的标注必须字高大小一样，字高 2.5mm，等比例缩放。

4、幕墙立面图绘制比例应合理，不能超过 1：300，必要时应分段绘制，比例要求必须遵循建筑制图标准。

5、幕墙立面图中应表示出幕墙开启扇的开启方式，出入口门的类型，雨篷的位置、类型及拉杆的位置高度等。

6、幕墙立面图中大的平面转折部位应标注转折角度。

7、若有女儿墙挡住部分幕墙立面，应采用虚线表示被挡住立面的轮廓及分格。

8、索引大样时应明确标注大样索引图的范围和索引号。如果有方向区分时，应表示出方向。

9、图纸图框上应有图纸名称、图纸编号、比例、索引位置、页码等，必要时可以表示设计要求等。

8. 大样图设计深度要求

不同类型的幕墙包括面板材料、结构形式和做法不同的幕墙，以及幕墙立面或平面比较复杂的部位，均应绘制大样图，比如大商业和底商等必要时全部做相交连续的局部大样图。

1、大样图应标明索引自立面或平面图纸的编号。

2、大样图绘制顺序应先设计主要大样，后设计次要大样。

3、大样图的设计内容至少应包括立面大样图、平面大样图（横剖）和墙身大样图（竖剖），每种不同的位置应要有相应的横剖和竖剖。

4、大样图应采取合适的比例，不能超过 1：100，主要大样图比例不能超过 1：50，必要时将局部立面大样图、横剖和竖剖相应的分成三张图布置，比例要求必须遵循建筑制图标准，保证图纸表达清楚。

5、大样图中应索引详细的节点图，将各部位的不同做法反映清楚，包括所有的收边收口节点、有墙体部分的幕墙处理、女儿墙处理节点、踢脚收口节点等。

6、大样图中应用填充的方式区分不同的材料，除胶缝可用单线条简单表示外，其余应按节点设计的实际情况表达清楚。

7、平面大样图应对面层的平面分格、立柱的位置及横梁与立柱的连接、防火保温做法等有清楚的表达，并与节点设计保持一致。

8、立面大样图和平面大样图均应表示出幕墙开启扇的开启方式及出入口门的形式等。

9、墙身大样图应对面材的立面分格、横梁的位置及与立柱的连接、防火保温做法等有清楚的表达，并与节点设计保持一致。

10、局部立面大样图的竖向标注和竖剖大样图应包括楼层标高标注、楼层号标注、竖向板块分格尺寸标注、层高标注等，尺寸标注必须跟相应的楼层标高有关系；局部立面大样图的横向标注和横剖大样图应包括幕墙板块的横向分格、幕墙厚度尺寸及幕墙种类的分界线，尺寸标注必须跟相邻轴线有关系，所有的标注必须字高大小一样，字高 2.5mm，等比例缩放。

11、图纸图框上应有图纸名称、图纸编号、比例、索引位置、页码等，必要时可以表示设计要求等。

9. 节点图设计深度要求

幕墙工程节点图应能清楚表现整个幕墙的材料及构造做法，对节点做法表达应完整清晰。

节点图应清晰准确的反映幕墙的具体做法和全部材料，幕墙承包范围内的材料均须在节点图内进行表现并准确的进行标注，在节点图上出现的不在幕墙承包范围内的材料，亦须明确标注为非承包项或以其它方式进行区分。

1、节点图应至少包括但不限于以下内容：

1）标准节点，包括标准横剖节点和标准纵剖节点。

2）纵剖节点，包括窗间墙纵剖节点、封顶纵剖节点、封底纵剖节点。

3）横剖节点，包括封边横剖节点，转角横剖节点。

4）立柱安装节点。

5）横梁安装节点。

6）功能节点，包括防雷、防火、防水、连接节点等。

6）开启扇五金配件装配图。

7）开模图。

2、节点图中应标明索引图纸的编号。节点图可以从大样图中索引，也可从其它节点图中索引，均应标注清楚，节点图应采取合适的比例，不能超过 1：6，标准节点比例应按 1：1 表示。

3、节点图绘制顺序应先绘制主要节点（包括标准节点、功能节点、安装节点、主要交接节点、梁间节点及女儿墙收口节点、踢脚收口节点等），后绘制辅助节点及收边节点。在设计主要节点时应注意考虑与辅助节点和收边节点的配合，尽量减少对辅助节点和收边节点的特殊处理。

4、节点图应表达清楚，标注详细，表达完整的设计思想，主要节点的应将所有的要求尺寸标注清楚，所有用的材料名称须标注清楚。

5、对幕墙的主要部分要进行详细设计，对墙角区和墙面区分开设计，不同楼层标高分开设计，确保节点做法安全、经济。

6、应根据制图规范及三视图的原理，对节点图中的参考投影线及投影面进行合理表达。

7、节点图中无法表示或标注清楚的部位应绘制放大节点图。

8、图纸图框上应有图纸名称、图纸编号、比例、索引位置、页码等，必要时可以表示设计要求等。

10. 埋件图设计深度要求

幕墙工程埋件图一般采用平面图方式表达，也可根据需要设计成立面图，比如主体结构立面上有布置了埋件的斜梁，则应绘制埋件立面图以准确表示埋件的定位。

1、埋件平面图应以幕墙平面图为基准，根据节点设计及结构设计，将幕墙埋件的实际平面位置表示清楚，标注埋件的施工定位尺寸，定位尺寸一般包括中心线间距及与相邻轴线的距离等。

2、应在埋件平面图的基础上绘制埋件剖面图，清楚表示各部位埋件的不同配置。剖面图上应表示埋件的施工定位尺寸、楼层标高、楼层名称、相关的轴线及其编号，以及与埋件有关的技术要求。

3、对不同的埋件，应绘制埋件加工图，标注详细，技术要求明确。

4、所有的楼层均须有相应的埋件平面图，应全面反映幕墙工程主体结构上埋件的配置和定位情况。

5、应注意区分不同类型埋件，如板式埋件和槽式埋件等的埋设范围。

11. 开模图设计深度要求

当幕墙工程中铝合金型材、胶条等存在需要新开模具的情况时，应对新开模的铝型材、胶条等绘制开模图，开模图属于节点图的一种。

1、开模图应进行编号，主要的铝型材或胶条编号在前，互相配合、关联的型材或胶条应连续编号。

2、开模图上应详细标注铝型材或胶条的细部尺寸、材质和表面处理等具体指标。

ATTACHMENT E **BIM SCOPE OF WORK AND REQUIREMENT**
附录 E **BIM 工作内容及要求**

关于幕墙施工单位需要完成的 BIM 工作内容及要求

1. BIM 工作要求

幕墙施工分包应负责在服务期内对业主的幕墙 BIM 管理顾问提供的 BIM 模型深化、更新和维护，并管理、协调、整合幕墙施工分包的 BIM 工作，BIM 模型必须包括幕墙工程设计，施工图模型，埋件，转接件，支撑结构和相邻的主体结构边梁板，以及幕墙施工措施等。幕墙施工分包根据发包人的 BIM 工作要求开展工作，按工作范围提交施工各阶段 BIM 成果，由顾问团队审核 BIM 成果是否满足本项目 BIM 深度要求，对审核发现的问题，幕墙施工分包须进行校核和调整 BIM 成果，直到满足前述 BIM 深度要求，确保 BIM 成果与幕墙施工分包提供的施工图纸文档一致。

1）使用 BIM 完成幕墙深化设计，加强设计对加工和施工的控制和指导；

2）幕墙施工图出图过程中配合具体节点提供三维模型验证；

3）使用 BIM 的进行参数化建模和设计，投标时需体现参数化设计能力；

4）应有基于 BIM 实现幕墙施工现场工况及加工构件的模拟的能力；

5）使用应用基于 BIM 进行幕墙构件加工和精度控制方面的应用的能力；

6）使用 BIM 模拟施工工艺、进度、现场，探讨施工方案，加强对施工过程的控制；

7）基于 BIM 提供能快速浏览的图片和视频，以便项目各参与方查看和审阅；

8）使用 BIM 实现幕墙设计、加工、施工三方的现场联动，投标时需提供实现该目标的具体实施方案；

9）使用 BIM 实现复杂形态结构施工偏差应对措施，描述具体实施方案。

幕墙施工分包应指定项目总工程师级别管理层人员兼任 BIM 总负责人协调、总控项目 BIM 应用，并指派一名 BIM 负责人在服务期内管理项目 BIM 团队。BIM 负责人作为幕墙施工分包 BIM 应用过程中的具体执行者，负责施工阶段 BIM 工作的沟通及协调，定期组织 BIM 工作会议，按要求出席项目例会、设计交底会等工程会议，特别强调在工程会议中 BIM 平台的作用。BIM 负责人在深化设计、施工过程中应与业主的幕墙 BIM 管理顾问、其他分包人、设计人及时沟通和协调。协助 BIM 总负责人确保整个项目 BIM 工作的完整性、准确性、延续性。

幕墙施工分包应建立完整的可以胜任服务期内所有 BIM 工作的专业团队，确保幕墙工程及特殊需求阶段均有专业工程师负责，并在开始 BIM 模型的创建和深化工作之前，提交业主的幕墙 BIM 管理顾问审核及批准 BIM 组织架构表、执行计划书及构件编码标准。

幕墙施工分包应按业主的幕墙 BIM 管理顾问要求向业主的幕墙 BIM 管理顾问提供 BIM 模型原始数据、转换数据（包括但不限于 CATIA、Digital Project、AutoCAD、Revit、Navisworks 等模型数据格式）及对 BIM 应用所需的各类信息，并保证模型中的幕墙构件的编码在模型中唯一性。

幕墙施工分包应在服务期内按业主的幕墙 BIM 管理顾问所要求的时间节点向业主的幕墙 BIM 管理顾问提交与深化设计、施工进度相一致的 BIM 模型，模型包含幕墙构件数据，比如名称，构件编号，几何尺寸，材料规格，材质，横截面，节点类型等。

幕墙施工分包应负责汇总、整理最终的幕墙工程 BIM 竣工模型，在项目结束时，向业主的幕墙 BIM 管理顾问提交真实准确的竣工 BIM 模型、BIM 应用资料和设备信息等，确保发包人和物业管理公司在运营阶段具备充足的信息。

幕墙施工分包应确保提供满足 BIM 模型应用要求的足够数量的软件和硬件设备。

2. 幕墙 BIM 工作内容

幕墙在施工前，由业主的幕墙 BIM 管理顾问提供基础 BIM 模型，由幕墙施工分包负责完成该项工程深化设计阶段全部的 BIM 模型。包含幕墙施工图设计的所有构件，施工图模型，埋件，转接件，支撑结构和相邻的主体结构边梁板。

幕墙 BIM 模型建立前，幕墙施工分包应与发包人、业主的幕墙 BIM 管理顾问就其 BIM 模型规划进行详细讨论，确定模型建立的精度、深度、模型应包括的信息、模型的后续使用等需求。

幕墙施工分包应在服务期内按业主的幕墙 BIM 管理顾问所要求的时间节点向业主的幕墙 BIM 管理顾问提交与深化设计、施工进度相一致的 BIM 模型，供业主的幕墙 BIM 管理顾问审核。对审核发现的问题，幕墙施工分包负责在业主的幕墙 BIM 管理顾问规定时间内修改完善，并提交业主的幕墙 BIM 管理顾问复审。

幕墙施工分包应使用幕墙 BIM 模型与其他分包人、设计人的其他专业 BIM 模型进行碰撞检查，并提交业主的幕墙 BIM 管理顾问冲突报告。

对于需要对原图（模型）进行改动的，由幕墙施工分包提供书面说明和 BIM 模型，由业主的幕墙 BIM 管理顾问组织各相关施工方予以确认。需要设计人和发包人参加时，由幕墙施工分包提出书面要求。

要求幕墙施工分包应用 BIM 模型重点部位进行幕墙吊装方案模拟和预拼装模拟等工作。

要求幕墙施工分包提供的 BIM 成果应包含幕墙典型节点 BIM 模型（深度满足幕墙节点的细部构造、与结构主体的连接方式、与其他专业的空间关系），用于指导施工。

要求幕墙施工分包基于 BIM 模型完成幕墙深化设计，范围包括塔楼、底部、屋顶、转角与入口等。

3. BIM 数据的所有权和权利

所有 BIM 模型以及所有其他项目过程中产生的数据都归属于发包人所有。

所有 3D，4D 和与 BIM 有关的信息均为保密信息。幕墙施工分包在发布这些信息之前，应确保得到发包人的书面同意和授权，并做好相关的数据传递/交接纪录。

ATTACHMENT F INSTALLALTION AND CONSTRUCTION REQUIREMENT

附录 F 安装施工要求

安装施工

1. 一般规定

1.1 点支承玻璃幕墙支承结构中的钢结构安装应符合现行国家标准《钢结构工程施工规范》GB 50755、《钢结构工程施工质量验收规范》GB 50205 的有关规定。

1.2 进场的幕墙构件及附件的材料品种、规格、色泽和性能应符合设计要求。幕墙构件安装前应进行检验，不合格的构件不得安装使用。

1.3 幕墙的安装施工应按现行国家标准《建筑施工组织设计规范》GB 50502 的有关规定单独编制施工组织设计，并应包括下列内容：

1 工程概况、组织机构、责任和权利、施工进度计划安排；

2 与主体结构施工、设备安装、装饰装修的协调配合方案；

3 搬运、吊装方法；

4 测量方法及注意事项；

5 安装方法及允许偏差要求，关键部位、重点、难点施工部位安装方法应单独标出；

6 安装顺序及嵌缝收口要求；

7 构件、组件和成品的现场保护方法；

8 质量要求及检查验收计划；

9 安全措施及劳动保护计划。

1.4 单元式玻璃幕墙的安装施工组织设计尚应包括下列内容：

1 单元件的运输及装卸方案；

2 对主体结构的垂直度和楼层外轮廓的测量、监控方案；

3 吊具的类型和吊具的移动方法，吊具的安装位置和对主体结构的荷载影响，单元组件起吊地点、垂直运输与楼层内水平运输方法和机具；

4 收口单元位置、收口闭口工艺及操作方法；

5 单元组件吊装顺序及吊装、调整、定位固定等方法和措施；

6 幕墙施工组织设计应与主体工程施工组织设计相互衔接，单元幕墙收口部位应与总施工平面图中施工机具的布置协调。

1.5 点支承玻璃幕墙的安装施工组织设计尚应包括下列内容：

1 支承钢结构的运输、现场拼装和吊装方案；

2 拉杆、拉索体系预拉力的施加、测量、调整方案以及索杆的定位、固定方法；

3 幕墙用玻璃的运输、就位、调整和固定方法；

4 胶缝的充填及质量保证措施。

1.6 **本工程严禁在施工现场打注硅酮结构密封胶。**

1.7 采用脚手架施工时，应制定脚手架方案。悬挂式脚手架宜为 3 层层高；落地式脚手架应为双排布置。

1.8 玻璃幕墙的施工测量应符合下列规定：

1 幕墙分格轴线的测量应与主体结构测量相配合，放线时应进行多次校正；

2 单元式幕墙施工时，应对主体结构施工过程中的垂直度和楼层外廓进行测量和监控；

3 施工时应定期对幕墙的安装定位基准进行校核；

4 对高层建筑幕墙的测量，应在风力不大于 4 级时进行。

1.9 幕墙安装过程中，构件存放、搬运、吊装时应避免损坏和污染；对型材、玻璃的表面应采取保护措施。

1.10 镀膜玻璃的镀膜面朝向应按设计要求安装。

1.11 进行焊接作业时，应采取避免焊接对幕墙构件产生影响的保护措施。施焊后应对受到焊接影响的部位进行处理。

1.12 可现场施工的硅酮建筑密封胶不宜在夜晚、雨天打胶，打胶温度应符合设计要求和产品要求，打胶前应保证打胶面清洁、干燥。

2. 安装施工准备

2.1 安装施工前，幕墙安装厂商应会同土建承包商检查现场幕墙施工条件。

2.2 构件储存时应依照安装顺序排列放置，储存架应有足够的承载能力和刚度。在室外储存时应采取保护措施。

2.3 主体结构中连接幕墙构件用预埋件缺失或位置偏差过大时，幕墙施工单位应与建设单位、主体结构设计单位及主体结构施工单位洽商后，制订补充连接措施方案并在幕墙安装前实施。

2.4 采用新材料、新技术的幕墙，宜在现场制作样板，经建设单位、监理、主体结构设计单位认可后方可进行安装施工。

3. 预埋件、后锚固连接件

3.1 玻璃幕墙与主体结构连接的预埋件，应在主体结构施工时按设计要求埋设。预埋件的焊接应符合现行国家标准《混凝土结构设计规范》GB 50010 或本规范附录 B 的规定。

3.2 预埋件的埋设位置应符合设计要求。预埋件锚筋应位于构件外层主筋的内侧。锚筋或锚爪至构件边缘的距离应符合现行国家标准《混凝土结构设计规范》GB 50010 或本规范附录 B 的规定。预埋件安装到位后，应采取有效措施对预埋件进行固定，并进行隐蔽工程验收。

3.3 锚栓孔的位置、直径、孔深和形状应符合设计要求。锚栓孔不应损伤主体结构构件钢筋。化学锚栓用锚栓孔应将孔壁的粉尘清理干净。

3.4 膨胀型锚栓和扩孔型锚栓安装时，应采取防止损坏锚栓头部螺纹的有效措施。

3.5 化学锚栓的安装应符合下列规定：

1 化学锚栓的表面应干燥、洁净无油污。

2 锚固胶容器无破损、药剂凝固等异常现象；放置方向和位置应符合产品要求。

3 螺杆安装时，宜采用专用工具，将螺杆旋转插入孔底；螺杆到达孔底后，应及时停止旋转。

4 螺杆安装完成后，应采取有效措施固定螺杆，防止螺杆松动、移位，并检查锚固胶固化情况。

3.6 后置锚栓安装完成后，应进行现场承载力试验检验。

3.7 后置锚固连接件锚板安装时，应采取防止后置锚栓螺母松动和锚板滑移的措施。

3.8 预埋件和后置锚固连接件锚板的安装允许偏差应符合下表。

预埋件和后置锚固连接件锚板的安装允许偏差（mm）

项　目 尺 寸	允许偏差
标高	±10
平面位置	±20

4. 构件式玻璃幕墙

4.1 玻璃幕墙立柱的安装应符合下列规定：

1 立柱安装轴线的允许偏差应为 2mm。

2 相邻两根立柱安装标高差不应大于 3mm，同层立柱最大标高差不应大于 5mm；相邻两根立柱固定点距离的允许偏差应为±2 mm。

3 立柱安装就位、调整后应及时紧固。

4.2 玻璃幕墙横梁的安装应符合下列规定：

1 横梁应安装牢固、贴缝严密。横梁与立柱间留有伸缩间隙时，其尺寸应满足设计要求；采用密封胶缝时，胶缝施工应均匀、密实、连续。

2 同一根横梁两端或相邻两根横梁端部的水平标高差不应大于 1mm。当一幅幕墙宽度不大于 35m 时，同层横梁最大标高偏差不应大于 5mm；当宽度大于 35m 时，不应大于 7mm。

3 安装完成一层后，应及时进行检查、校正和固定。

4.3 玻璃幕墙其他附件安装应符合下列规定：

1 隔热层及防火、保温材料应铺设平整、可靠固定，拼接处不应留缝隙；

2 冷凝水排出管及其附件应与水平构件预留孔连接严密，与内衬板排水孔连接处应采取密封措施；

3 通气槽、孔及雨水排出口等应按设计要求施工，不得遗漏；

4 封口处应进行封闭处理；

5 安装施工采用的临时螺栓应在幕墙固定后拆除；

6 采用现场焊接或高强螺栓紧固的构件，应在紧固后进行防锈处理。

4.4 幕墙玻璃安装应符合下列规定：

1 玻璃安装前应进行表面清洁；除设计另有要求外，应将单片阳光控制镀膜玻璃的镀膜面朝向室内，非镀膜面朝向室外。

2 应按规定型号选用玻璃四周的橡胶条，其长度宜比边框内槽口长 1.5%～2.0%；橡胶条斜面断开后应拼成预定的设计角度，并应采用专用粘结剂粘结牢固；橡胶条镶嵌应平整。

4.5 铝合金装饰压板的安装，应表面平整、色彩一致，接缝应均匀严密。

4.6 构件式玻璃幕墙中硅酮建筑密封胶在接缝内应两对面粘结，不应三面粘结。

5. 单元式玻璃幕墙

5.1 单元式幕墙的吊装应符合下列规定：

1 安装单元板块的吊装机具应进行专门设计；吊装机具的承载能力应大于板块吊装施工荷载和作用组合设计值；

2 应对吊装机具安装位置的主体结构承载能力进行校核；吊装机具应与主体结构可靠连接，并有防止脱轨或限位、防倾覆设施；

3 应采取减小板块在垂直运输和吊装过程中摆动的措施，；

4 吊装机具上宜设置防止板块坠落的保护设施、行程开关；

5 吊装机具运行速度应可控制，并有安全保护措施；

6 吊装前应对吊装机具进行检验，并进行空载试运转；

7 定期对吊挂用钢丝绳进行检查，发现断股应及时更换；

8 定期对吊装机具进行检查、保养，吊装机具存在问题应立即停工修理；

9 吊装机具操作人员应经培训并考核合格；

10 吊装机具应设置防雨、防潮和防尘措施；

11 单元板块的吊挂件、支撑件应具备可调整范围，吊挂件应采用不锈钢螺栓与立柱固定牢固，固定螺栓不得少于 2 个。

5.2 单元组件运输应符合下列规定：

1 单元组件运输时应摆放平稳、固定牢靠，防止板块或型材变形，板块的摆放方向应符合运输要求；

2 装卸及运输过程中应采用周转架、衬垫或弹性垫固定并分隔单元板块，周转架、衬垫或弹性垫的承载力和刚度应满足要求；

3 异形板块和超过运输允许尺寸的单元板块，应制订专门运输方案及措施；

4 运输过程中应设置防止颠簸和恶劣天气的措施；

5 楼层上设置的接料平台应进行专门设计，接料平台的承载能力应大于板块、周转架的最大自重以及搬运人员体重和其他施工荷载的组合设计值，接料平台的周边应设置防护栏杆。

5.3 在场内堆放单元板块时，应符合下列规定：

1 宜设置专用堆放场地，并应有安全保护措施；

2 短期露天存放时应采取防水、防火和遮阳措施。

3 宜存放在专用周转架上。

4 应按照安装顺序先出后进的原则按编号排列放置。

5 不应直接叠层堆放。

6 不宜频繁搬动。

5.4 单元板块起吊和就位应符合下列规定：

1 吊点和挂点应符合设计要求，吊点不应少于 2 个，吊点承载力不足时可增设吊点加固措施，并应进行试吊装；

2 起吊板块的重量不应超过吊具起重量和接料平台的承载能力；

3 起吊单元板块时，应使各吊点均匀受力，起吊过程应保持单元板块平稳；

4 吊装升降和平移应使单元板块不摆动、不撞击其他物体；

5 吊装过程应采取措施保证装饰面不受磨损和挤压；

6 单元板块就位时，应先将其挂到主体结构的挂点上再进行其他工序，板块未固定前，吊具不得拆除。

5.5 固定于主体结构上的连接件安装，应符合下列规定：

1 连接件调整完毕后，应及时进行防腐处理；

2 连接件安装允许偏差应符合下表的规定。

连接件安装允许偏差

项　　目	允许偏差(mm)	检查方法
标高	±1.0； 可上、下调节时 ±2.0	水准仪
连接件两端点平行度	1.0	金属直尺
距安装轴线水平距离	1.0	金属直尺
垂直偏差(上、下两端点与垂线偏差)	1.0	金属直尺
两连接件连接点中心水平距离	±1.0	金属直尺
两连接件上、下端对角线差	1.0	金属直尺
相邻三连接件（上下、左右）偏差	±1.0	金属直尺

5.6 单元板块安装应符合下列规定：

1 单元板块安装前，应对下一层板块的上横框型材进行清理，并检查板块接口之间的防水装置、密封措施；

2 安装施工中严禁用铁锤等敲击板块；

3 板块安装后应测量幕墙的水平度和垂直度，偏差不应大于板块相应边长的 1/1000；

4 单元板块就位后应调整、校正；

5 单元板块调整、校正后应安装防松脱、防双向滑移和防倾覆装置，采用焊接施工时应对焊接部位进行防腐处理。

6 单元板块固定完成后，应清洁单元板块型材槽口，并按设计要求对板块接口进行防水密封处理。

7 防火材料应采用锚钉固定牢固，防火层应平整，拼接处不留缝隙，完成后应进行隐蔽工程验收；

8 幕墙工程安装完毕后，应清洁幕墙；清洁时不应选用可腐蚀和污染已安装完毕的幕墙的清洁剂；

6 单元板块固定后方可拆除吊具，并应及时清洁单元板块的型材封口。

5.7 单元式幕墙安装固定后的允许偏差应符合下表的规定。

单元式幕墙安装允许偏差

项 目		允许偏差（mm）	检查方法
竖缝及墙面垂直度	$H\leq30$m	10.0	激光经纬仪 或经纬仪
	30m<$H\leq60$m	15.0	
	60m<$H\leq90$m	20.0	
	90m<$H\leq150$m	25.0	
	$H>150$m	30.0	

幕墙平面度		2.5	2m 靠尺、金属直尺
竖缝直线度		2.5	2m 靠尺、金属直尺
横缝直线度		2.5	2m 靠尺、金属直尺
单元间接缝宽度（与设计值比）		±2.0	卡尺
耐候胶缝直线度	*L*≤20m	1.0	激光经纬仪 或经纬仪
	20m< *L*≤60m	3.0	
	60m< *L*≤100m	6.0	
	L >100m	10.0	
同层单元组件标高差	*B*≤35m	3.0	激光经纬仪或经纬仪
	B>35m	5.0	
两相邻面板之间接缝高低差		1.0	深度尺
两组件对插件接缝搭接长度 (与设计值比)		±1.0	卡尺
两组件对插件距槽底距离 (与设计值比)		±1.0	卡尺

注：*H* 为幕墙总高度，*B* 为幕墙宽度，*L* 为耐候胶缝长度。

5.8 施工中如暂停安装，应对板块对插槽口等部位进行保护；施工过程中应对安装完毕的单元板块及时进行成品保护。

6. 点支承玻璃幕墙

6.1 点支承玻璃幕墙爪件安装前应确定其安装位置。爪件安装的允许偏差应符合下表的规定。

点支承玻璃幕墙支承结构安装允许偏差

名称	允许偏差（mm）
相邻两竖向构件间距	±2.5
竖向构件垂直度	*l*/1000 或 5.0，*l* 为跨度
相邻三竖向构件外表面平面度	5.0
相邻两爪座水平间距和竖向距离	±1.5
相邻两爪座水平高低差	1.5
爪座水平度	2.0
同层高度内爪座高低差： 间距不大于 35m 间距大于 35m	5.0 7.0
相邻两爪座垂直间距	±2.0
单个分格爪座对角线差	4.0
爪座端面平面度	6.0

6.2 点支承玻璃幕墙面板安装允许偏差应符合下表的规定。

点支承玻璃幕墙玻璃面板安装质量允许偏差

项 目	尺 寸 范 围	允许偏差（mm）	检查方法

相邻两玻璃面接缝高低差	——	1.0	金属直尺
上下两玻璃接缝垂直偏差	——	1.0	2.0 m 靠尺
左右两玻璃接缝水平偏差	——	1.0	2.0 m 靠尺
玻璃外表面垂直接缝偏差	H≤20 m	3.0	金属直尺
	H > 20 m	5.0	
玻璃外表面水平接缝偏差	L≤20 m	3.0	金属直尺
	L > 20 m	5.0	
玻璃外表面平整度	H（L）≤20 m	4.0	激光仪
	H（L）> 20 m	6.0	
胶缝宽度（与设计值比）	——	±1.5	金属直尺

7. 张拉索杆支承结构

7.1 幕墙张拉索杆支承结构的安装施工应符合国家现行标准《钢结构工程施工规范》GB 50755、《索结构技术规程》JGJ 257 的有关规定。

7.2 张拉索杆支承结构中拉杆和拉索预拉力的施加应符合下列规定：

1 钢拉杆和钢拉索应按设计要求施加预拉力，并宜设置预拉力调节装置。

2 钢拉杆和钢拉索采用液压千斤顶张拉时，预拉力宜采用油压表控制；分级张拉结束时，宜采用测力计进行拉力复核。

3 钢拉杆采用扭力扳手施加预拉力时，应事先进行标定。

4 张拉前应评估索体张拉对相邻索位形及其中张拉力的影响。

5 施加预应力宜以张拉力为控制量；对结构重要部位宜进行索力和位移双控。

6 拉索张拉应对称、缓慢匀速进行；在张拉过程中，应对拉杆、拉索的预拉力依据现场实际状况作进行调整。

7 张拉前应对构件、锚具等进行全面检查，并应签发张拉通知单。张拉通知单应包括张拉日期、张拉分批次数、每次张拉控制力、张拉用机具、测力仪器及使用安全措施和注意事项。

8 应建立张拉记录。

9 拉杆、拉索实际施加的预拉力值应考虑施工温度的影响。

10 索杆张拉可根据支承结构的受力特性采用千斤顶直接张拉、拉索调节器调节、索端支座强迫就位、索体横向牵拉或顶推的方法进行。

7.3 玻璃幕墙张拉索杆支承结构施工完成后，在面板安装前可根据重力荷载分布情况悬挂配重荷载，索体位形调整正确后，再替换配重安装面板。配重重量可取面板自重的 1.05~1.15 倍。

8. 安全规定

8.1 幕墙的安装施工除应符合现行行业标准《建筑施工高处作业安全技术规范》JGJ 80、《建筑机械使用安全技术规程》JGJ 33、《施工现场临时用电安全技术规范》JGJ 46 的有关规定外，尚应遵守施工组织设计中确定的各项要求。

8.2 安装施工机具在使用前，应进行安全检查。电动工具应进行绝缘电压试验。

8.3 当幕墙安装与主体结构施工交叉作业时，在主体结构的施工层下方应设置防护设施；在距离地面约 3m 高度处，应设置挑出宽度不小于 6m 的水平防护设施。

8.4 采用吊篮施工时，应符合下列规定：

1 施工吊篮应进行设计，使用前应进行安全性检查。

2 安装吊篮的场地应平整，安装部位应能承受吊篮自重和各种施工荷载的组合设计值。

3 吊篮用配重与吊篮应可靠连接。

4 使用前应进行空载运转并检查安全锁性能；进行安全锁试验时，吊篮离地面高度不应超过 2m，并应进行单侧试验。

5 吊篮操作人员应经培训上岗。

6 施工吊篮不应作为竖向运输工具，并不得超载。

7 不应在空中进行施工吊篮检修和进出吊篮。

8 施工吊篮上的施工工人应佩戴安全帽、安全带，安全带应系在保险绳上并与主体结构有效连接。

9 吊篮上不应放置电焊机，吊篮和钢丝绳不应作为焊接地线。

10 收工完成后吊篮应降至地面并切断吊篮电源，吊篮及吊篮钢丝绳应固定牢靠，并做好电器防雨、防潮和防尘措施。长期停用时，应对钢丝绳采取有效的防锈措施。

8.5 不应在脚手架或吊篮上进行加工作业；施工工具不应在建筑窗台、挑台上放置。

8.6 现场焊接作业时，应评估焊接作业的影响范围并采取防火措施。

8.7 施工过程中应及时清理施工现场遗留的杂物。

ATTACHMENT G **FINAL INSPECTION REQUIREMENT**
附录 G **工程验收要求**

工程验收

1. 一般规定

1.1 玻璃幕墙工程验收时，应根据工程实际情况提交下列部分或全部资料：

1 幕墙工程的竣工图或施工图、结构计算书、热工性能计算书、设计变更文件、设计说明及其他设计文件；

2 建筑设计单位对玻璃幕墙工程设计的确认文件；

3 玻璃幕墙工程所用材料、构件及组件、紧固件及其他附件的产品合格证书、性能检测报告、进场验收记录；

4 均质钢化玻璃除应提供产品合格证外，尚应提供均质加工过程记录；

5 玻璃幕墙工程所用硅酮结构胶的认定证书、抽查合格证明、相容性试验报告和剥离粘结性试验报告；

6 后置预埋件的现场拉拔检测报告、槽式预埋件的现场拉拔强度检测报告；

7 封闭式玻璃幕墙的抗风压性能、气密性能、水密性能检测报告；有要求时尚应提供平面内变形性能检测报告；

8 开放式玻璃幕墙的抗风压性能检测报告；

9 注胶、养护环境的温度、湿度记录，双组份硅酮结构胶的混匀性试验记录及拉断试验记录；

10 幕墙与主体结构防雷接地点之间的电阻检测记录；

11 隐蔽工程验收文件；

12 幕墙安装施工质量检查记录；

13 张拉索杆体系预拉力张拉记录；

14 现场淋水试验记录；

15 其他质量保证资料。

1.2 玻璃幕墙工程应对下列材料进行复检：

1 主受力杆件的铝材、钢材的抗拉强度；

2 防火、保温材料的燃烧性能；

3 结构胶的邵氏硬度、标准状态下的拉伸粘结强度；

4 中空玻璃密封性能。

1.3 幕墙工程应对下列隐蔽工程项目进行验收：

1 预埋件或后置埋件、锚栓及连接件；

2 构件与主体结构的连接节点；

3 玻璃幕墙四周、玻璃幕墙内表面与主体结构之间的封堵构造节点；

4 玻璃幕墙伸缩缝、变形缝、沉降缝及墙面转角处的构造节点；

5 隐框玻璃板块的固定；

6 幕墙防雷构造节点；

7 幕墙防火、隔烟构造节点；

8 单元式玻璃幕墙的封口节点。

1.4 玻璃幕墙工程应进行观感检验和抽样检验，且每幅玻璃幕墙均应检验。幕墙工程质

量验收的检验批划分应符合下列规定：

1 相同设计、材料、工艺和施工条件的玻璃幕墙工程每 1000m^2 应划分为一个检验批，不足 1000m^2 也应划分为一个检验批；每个检验批每 100m^2 应至少抽查一处，每处不得小于 10m^2；

2 同一单位工程的不连续的玻璃幕墙工程应单独划分检验批；

3 对于异型或特殊要求的玻璃幕墙，检验批的划分应根据玻璃幕墙的结构、工艺特点及玻璃幕墙工程规模，由监理单位、建设单位和施工单位协商确定。

2. 主控项目

2.1 玻璃幕墙工程所使用的各种材料、构件和组件的质量，应符合设计要求。

检验方法：检查材料、构件、组件的产品合格证书、进场验收记录、性能检测报告和材料的复验报告。

2.2 主体结构的预埋件、后置埋件的位置、数量、规格尺寸及槽式预埋件、后置埋件的拉拔力应符合设计要求。

检验方法：检查进场验收记录、隐蔽工程验收记录；槽型预埋件、后置埋件的拉拔试验检测报告。

2.3 玻璃幕墙骨架与主体结构预埋件或后置埋件的连接、幕墙构件之间的连接位置、面板连接件与面板的连接、面板连接件与幕墙骨架的连接应符合设计要求。

检验方法：手扳检查；检查隐蔽工程验收记录。

2.4 隐框或半隐框玻璃幕墙托条的数量、规格、尺寸、材质应符合设计要求。

检验方法：观察；检查施工记录。

2.5 玻璃幕墙的防火、保温材料的设置应符合设计要求。

检验方法：观察；检查隐蔽工程验收记录。

2.6 玻璃幕墙节点、变形缝、墙角的连接节点应符合设计要求。

检验方法：检查隐蔽工程验收记录和施工记录。

2.7 玻璃幕墙开启扇的配件应齐全，安装应牢固，安装位置和开启方向、角度及开启距离应符合设计要求；开启应灵活，关闭应严密。

检验方法：观察；手扳检查；开启和关闭检查。

3. 一般项目

3.1 玻璃幕墙表面应平整、洁净；整幅玻璃的色泽均匀；不得有污染和镀膜损坏。

检验方法：观察；检查进场验收记录。

3.2 每平方米玻璃的表面质量和检验方法应符合下表的规定。

每平方米玻璃的表面质量和检验方法

项目	质量要求	检验方法
明显划伤和长度＞100mm 的轻微划伤	不允许	观察
长度≤100mm 的轻微划伤	不多于 8 条	金属直尺
擦伤总面积	不大于 500mm^2	金属直尺

3.3 一个分格铝合金型材的表面质量和检验方法应符合下表的规定

一个分格铝合金型材的表面质量和检验方法

项目	质量要求	检验方法
明显划伤和长度＞100mm 的轻微划伤	不允许	观察
长度≤100mm 的轻微划伤	不多于 2 条	金属直尺
擦伤总面积	不大于 500mm^2	金属直尺

3.4 明框玻璃幕墙的外露框料或装饰压板应光滑顺直，颜色、规格应符合设计要求，压板安装应牢固。单元玻璃幕墙的单元接缝或隐框玻璃的分格玻璃接缝应光滑顺直、均匀一致。

检验方法：观察；手扳检查；检查进场验收记录。

3.5 玻璃幕墙的密封胶缝应平横竖直、深浅一致、宽窄均匀、光滑顺直。

检验方法：观察；手摸检查。

3.6 玻璃幕墙隐蔽节点的遮封装修牢固、整齐、美观。

检验方法：观察；手扳检查。

3.7 明框玻璃幕墙安装允许偏差和检验方法应符合下表的规定。

明框玻璃幕安装允许偏差和检验方法

项目		允许偏差(mm)	检验方法
幕墙垂直度	H≤30m	10.0	激光经纬仪或经纬仪
	30m<H≤60m	15.0	
	60m<H≤90m	20.0	
	90m<H≤150m	25.0	
	H＞150m	30.0	
幕墙水平度	B≤35m	5.0	水平仪
	B>35m	7.0	
构件直线度		2.0	2m 靠尺和塞尺
构件水平度	L_1≤2m	2.0	水平仪
	L_1>2m	3.0	
相邻构件错位		1.0	金属直尺
分格框对角线长度差	L_2≤2m	3.0	金属直尺
	L_2>2m	4.0	

注：H 为幕墙总高度，B 为幕墙宽度，L_1 为构件长度, L_2 为对角线长度

3.8 隐框、半隐框玻璃幕墙安装允许偏差和检验方法应符合下表的规定。

隐框、半隐框玻璃幕墙安装允许偏差和检验方法

项目		允许偏差	检验方法
墙面垂直度（幕墙高度 H）	H≤30m	10.0mm	激光经纬仪或经纬仪
	30m< H≤60m	15.0 mm	
	60m< H≤90m	20.0 mm	
	90m< H≤150m	25.0 mm	
	H>150m	30.0mm	
幕墙水平度	B≤35m	5.0 mm	水平仪
	B>35m	7.0 mm	
幕墙表面平整度		2.0 mm	2m 靠尺和塞尺
板材立面垂直度		2.0 mm	2m 靠尺和塞尺

板材上沿水平度	2.0 mm	2m 靠尺和塞尺
相邻板材板角错位	1.0 mm	金属直尺
阳角方正	±2°	量角器
接缝直线度	3.0 mm	2m 靠尺和塞尺
接缝高低差	1.0 mm	金属直尺
接缝宽度	±1.0 mm	金属直尺

注：*H* 为幕墙总高度，*B* 为幕墙宽度

3.9 点支承玻璃幕墙安装允许偏差和检验方法应符合下表的规定。

点支承玻璃幕墙安装允许偏差和检验方法

项目		允许偏差（mm）	检验方法
竖缝及墙面垂直度	高度不大于 30m	10.0	经纬仪
	高度大于 30m 但不大于 50m	15.0	
平面度		2.5	2m 靠尺、金属直尺
接缝直线度		2.5	2m 靠尺、金属直尺
接缝宽度		±2.0	卡尺
接缝高低差		1.0	塞尺

3.10 单元式玻璃幕墙安装允许偏差和检验方法应符合下表的规定。

单元式玻璃幕墙安装允许偏差和检验方法

项目		允许偏差（mm）	检验方法
幕墙垂直度	*H*≤30m	10.0	激光经纬仪或经纬仪
	30m<*H*≤60m	15.0	
	60m<*H*≤90m	20.0	
	90m<*H*≤150m	25.0	
	H＞150m	30.0	
墙面平面度		2.5	2m 靠尺和塞尺
竖缝直线度		2.5	2m 靠尺和塞尺
横缝直线度		2.5	2m 靠尺和塞尺
单元间接缝宽度（与设计值比）		±2.0	金属直尺
相邻两单元接缝面板高低差		1.0	深度尺
单元对插配合间隙（与设计值比）		+1.0 0.0	金属直尺
单元对插搭接长度		±1.0	金属直尺

注：*H* 为幕墙总高度

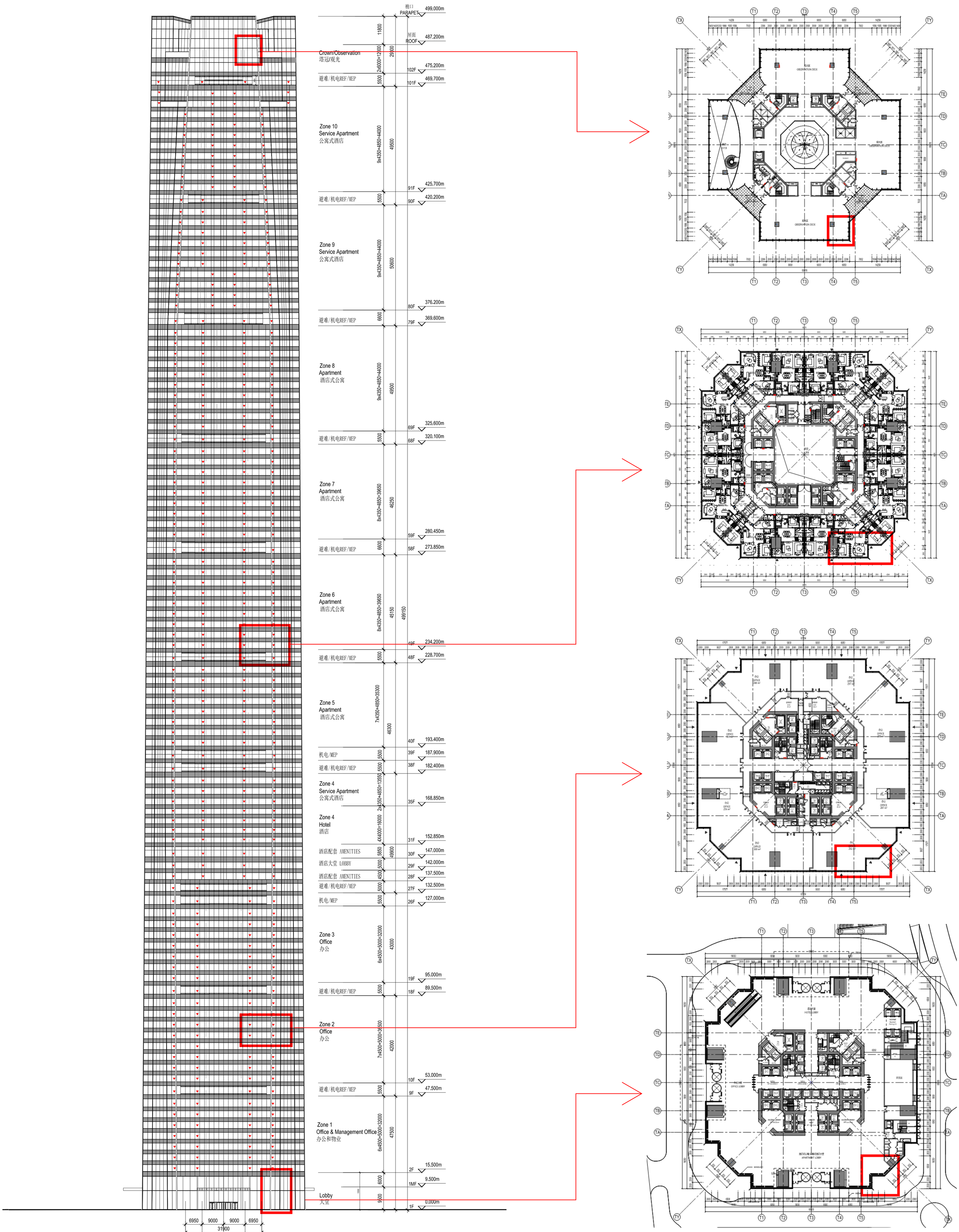
3.11 玻璃幕墙的金属构架应与主体防雷装置可靠接通，并应符合设计要求。

检验方法：观察；检查隐蔽工程验收记录。

3.12 玻璃幕墙的水密性应符合设计要求。

检测方法：淋水试验。

ATTACHMENT H VMU SCOPE
附录 H **视觉样板范围**



西立面图 WEST ELEVATION
SCALE: 1:750

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VMU Location Proposal
视觉样板位置建议