

Study on the Adaptability of Urban Design of the World EXPO

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Expo, as the world highest level of universal exhibition, is known as the "Olympic in the fields of economy, culture, science and technology" because of its role in promoting economic and social development. On December 3, 2002, the Bureau of International Expositions (BIE) at the 132nd General Assembly announced that Shanghai was the right to host the 2010 World Expo. As the first universal exhibition hosted by a developing country, World EXPO 2010 is not only an opportunity for Shanghai urban development, but an important measure for China's international development strategy.

In order to response to "Better City, Better Life" theme, the Expo planning team proposed the "harmonious" design concept, hoping that the six months of Expo will promote Shanghai's long-term development of the next 60 years, which has set a higher requirements for the planning and construction of the Expo Park.

1. Description of Expo Park Urban Design Preparation

On August 2004, Expo Park Planning Proposal, through the multi-stage such as the scope adjustment, special studies, proposal collection and integrated optimization, formed the first round of integrated proposal.

On August 2005, Expo Park General Plan and Regulatory plans were completed and 18 special plans were completed over the same period ¹ –thus, the framework document of the planning technical level was initially was completed.

On November 2005, the General Plan Working Group ² officially launched the Expo Park Urban Design. Such work preceded the General Plan and Regulatory plan and followed the building, landscape and special design, which not only focused on the design of architectural space environment, but also stressed the closer convergence with other professional programs; the final results were further transformed into the technical documents of attracting investment and exhibition -inviting for Expo.

On July 2006, Expo Park Urban Design was basically completed ³.

2. Problems during the preparation of urban design

Since the scale of the Expo Park is great and the contents are complex and that it is required "once plan, once completion", the urban design work varies from the traditional one-way process from the planning to special design, there is a repeated cycle and ever-expanding content dynamic process ⁴.

2.1 The Complex Existing Built Environment

Expo Park is located within Nanpu Bridge and Lupu Bridge along the waterfront of Huangpu River to Shanghai city layout. Expo Park site range from 5.28 sq. km (Fenced area range of about 3.28 sq. km), of which part is 3.93 sq. km in Pudong and Puxi section of 1.35 sq. km (Fig. 1). This site is the birthplace of Shanghai's modern industry. The site covers a total of about 2 ten thousand households, 273 enterprises movement. There are a number of historical protection buildings (Table 1, Fig. 2), including the Jiangnan Shipyard built in 1865, on behalf of the origin of China's modern industry.

The specific background determines that, in addition that large number of new buildings needs to construct within the range of 5.28 sq. km, many tasks must be faced, such as the urban renewal, land function change, industrial layout adjustment and reconstruction of the integrated service functions.

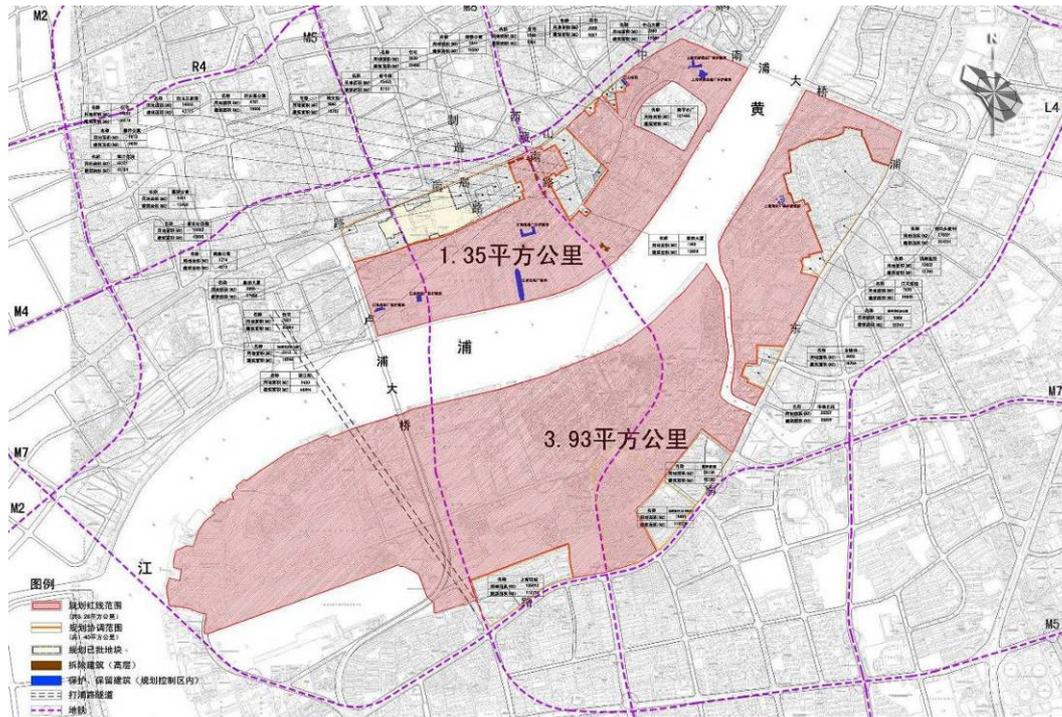


Fig. 1: Red Line of the World Expo (<http://www.expo2010.cn/>)

Name		Number	Floor Area (ha)	Gross Floor Area (sq.m)	Existing function	Planned function
Jiangnan Shipyard	Office building	LW-J-014-II	0.24	5007	General office	VIP reception
	Hangars	LW-J-014-II	0.11	1632	Workshop of motor department	Supporting service facilities
	Old site of Commander Department of the Navy	LW-J-014-II	0.087	2033	Office building of machinery fitting workshop	Supporting service facilities
	Old site of 2#dock	LW-J-014-II	0.57			Places of cultural activities
Qiuxin Shipyard	Red building	HP-J-023-III				Museum
	Office building	HP-J-023-III				Museum
Sanshan Guildhall		NS-W-002-S	0.35	725	Municipality Protected Historic Site (within the coordination area)	

Table 1: List of historic preservation buildings at World Expo Puxi Area



Fig. 2: Existing buildings at Puxi Area

2.2 Construction Coordination Simultaneously Launched

From the international proposal collection in 2004 to the building completion and operation in 2010, Expo needs to be completed the whole operation from planning concept to construction and implementation within less than 6 years. At the Expo Park, the new construction area is over 2 million sq. m, also involving in 5 metro lines and 2 cross-river tunnels. Up in 2006, the exhibition-inviting work started. More than one hundred countries, international organizations and enterprises joined, bringing the materialization of the pavilions. Over the same period, municipal infrastructure has also kicked off round⁵, involving in the types of facilities with a total of 19 categories, more than 110 items covering all areas of urban construction⁶.

To achieve the strong guide to construction implementation, the planning and design need to further comb construction sequence comprehensively on the basis of the "static" blueprint, and complete co-ordination and overlap of all the tasks. The urban design during this period, excluding the conventional "blueprint" type results, are more the interaction with the planning, operation, management and construction departments in the process, and are the coordination of problems and conflict from all aspects.

2.3 Taking Into Account Needs of Short-term & Long-term Development

The success of the Expo Planning, except for the controversial financial estimation and environment assessment difficult to measure, the planning will need to attach great importance to the construction of infrastructure as a whole before Shanghai Expo as well as the continuous use of the land and pavilions after Shanghai Expo.

In accordance with this requirement, urban design put forward different spatial functions and image demands. The follow-up specific research in early 2004 officially put forward the structure of "One Major and Several Minor" (Fig. 3), diving into the core areas and non-core areas – the main buildings permanently retained will be built at the core area, and the temporary pavilions and structures will be built at the non-core areas. The consequent problems include how the urban design creates the attraction of the non-core areas as well

how to achieve the site good balance through the activity planning for visitor flow guide to create a multi-level bright space. Even looking at the situation from today's scene, there is still uneven attractive distribution at the core areas and non-core areas, which will be balanced through the next step of the activity planning and visitor flow guide.

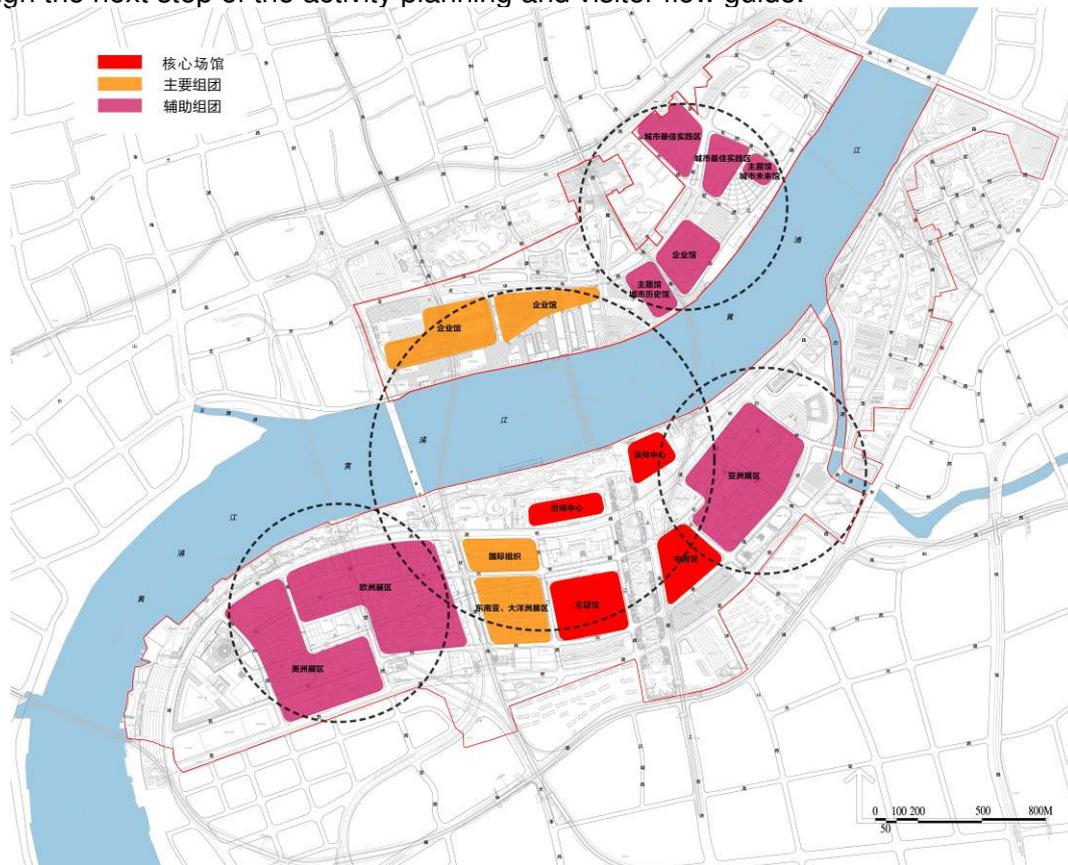


Fig. 3: Expo Planning Structure

2.4 Legacy of the Above Planning

General Plan and Regulatory Plan mainly emphasize on the static space requirement estimation and indicator measured distribution of visitors and exhibitors on the basis of the total satisfaction. But the urban design must solve the dynamic problems of the total flow of 70 million visitors, 380,000 visitors daily, millions of people passengers at extreme. The uncertainty of the visitor flow density also has brought extraordinary pressure to the urban design. According to the actual situation after the Expo was opened in 2010, even if the visitors are below 0.2 million, the crowded situation due to lining up also will occur at the popular pavilion.

Thus, urban design must return to the "human scale", that is, according to the visit need and uncertainty factor of operation process, the flow line is rationally organized to lead the dynamic distribution of the visitor flow, especially the design of the entrance and exit, access, public squares and the surrounding space of large pavilion shall be refined to really achieve one Expo with a pleasant scale and rich connotation.

3. Exploration and Practice of Adaptable Urban Design

Originally from the theory of evolution by Charles Robert Darwin, a British biologist, the *Adaptability* is used to interpret the adaptable relations of evolution and living environment of the biological population. Later developed by P. M. Rossby, a British geographer and H.H. Barrows, an American geographer, Darwin's concept preliminarily formed a kind of adaptability theory with "ecological harmony" as its core⁷. In the 1960s, the theory of western modern urban city emerged. The planner rethought the nature of the urban design; therefore the adaptable factor of urban design has been widely expanded, involving physical form,

cultural form and operational mode. Its connotation also broadens to adaptability of regulations & policies, finance & economy, government functions, public intentions, etc. from that of natural conditions, technical means and monomer function.

It is held by the modern ekistics that in correspondence of **Rigid Rules of Law** coming down in one continuous line of legally General and Regulatory Plan, the urban construction also requires exploration of **Soft Technical Means** which is able to be revised, such as that of the development strategy of urban space, urban design, etc..

As the world top grade universal exhibition China has ever undertaken, the Shanghai Expo is short of reference of modular experience either in construction scale or in organization and operation; therefore urban design is brought into the preparation of Expo by being considered as a kind of particular means connecting programming, planning, construction and operation. The adaptability of urban design emphasizes compiling the adaptability and adjustment of the main body to the objective working environment during this process. It can be specifically stated in target setting, working method and guarantee.

3.1 Target of Adaptable Urban Design: Control and Guide

The target of planning is to control and guide the well-organized urban construction. However, in face of large scale and intensive urban construction of Shanghai Expo, a number of out-of-order constructions easily occur due to lack of sufficient time to conduct detailed prophase study; therefore it is more necessary for us to think about the return of planning nature and rethink profoundly how the urban design should adapt to the Manager and the Constructor and how the relations between control and guide should be specified.

Relative to the control regulations for positions of legal document, the urban design, as the technical document, shall emphasize on the mutual relations among general frameworks and specific development & constriction objective; thereby subdivide the key parts selectively, arrange time sequence of construction, show the order of priority and adjust relevant planning feedbacks in time rather than only focus on how to depict the perfect blueprint.

There out, the key buildings (including reconstruction of core pavilions and historic buildings), plaza system (including ground plazas and elevated pedestrians' walk) and matching infrastructures have become the key content of Urban Design Manual. Besides the regulated indexes of continuous Regulatory Plan and diagram control⁹, the Guide also considers intensive flexible guide of schematic combination of pictures and context.

- Key projects, represented by core pavilions such as Four Pavilions (China Pavilion, Conference Center, Performance Center and Expo Axis), are listed as Class A Control Area which will be thought in details. Increasingly explicit projects are separated from the "equal treatment without discrimination" and their construction time of sequence shall be adjusted in time. For a number of national, enterprise and regional pavilions, Three Level management measures of regulation, coordination and guide shall be taken to make them in conformity of the general construction rhythm.

- Correct the other professional systems and carry forward the substantial construction procedure. In early 2006, significant municipal infrastructures were officially brought into the category of basic information of urban design. With the priority of advancement, public green areas, water affairs and municipal roads are taken as the key control targets. Other aspects, including underground space, sanitation, electric power, communication, gas, water supply, disaster prevention, etc., are in coordination and synchronous advancement by marketization means.

- Offer targeted suggestions in public parts of the system, such as passageway plazas, road traffic, etc. and advance, with concentration, the construction of collection, evacuation and transportation systems for metro traffic and special line buses through the overall study of traffic organization of external cities. Take other means of transportation as supplement and control it in the form of outskirts traffic protection ring.

As the "smart" process of superior planning, the urban design of Shanghai Expo pays more attention to the guided practice of "controlling what should not happen" rather than "how to do", which provides abundant selectable space for the furtherance in the next step; therefore it is called "optional urban design" by planners' team.

3.2 Method of Adaptable Urban Design: Uniform Platform and Specific Planning

The organization and operation of urban construction generally build System of Department Joint Conference System (or Planning Committee organized by government functional departments) taking the planning section as the cock. By taking the system as a platform, the original external consultation is changed to internal verification to form effective coordinating mechanism.

The Expo Planning establishes a uniform platform represented by “3+1+3+1” mode.

“1” indicates one Chief Planner team in charge of overall control and planning coordination. The first “3” means three government departments, including Shanghai Municipal Development & Reform Commission, Shanghai Urban Planning Bureau and Shanghai World Expo Coordination Bureau, which plan the development program, construction planning and project management as a whole; the second “3” stands for three designers, including specialty in construction, planning and municipal administration. The last “1” indicates the Shanghai Expo Group in charge of attracting investment and operation. This urban design method which adapts the special construction demand and working background is in sharp contrast with the composted design finished by an architect or an office in all previous World Expo. (Fig. 4)

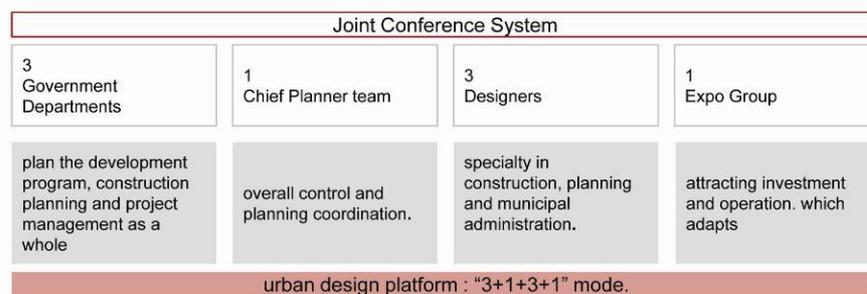


Fig. 4: Joint Conference System of World Expo and the “3+1+3+1” mode

One major work of urban design is to dynamically connect with various special planning. If coordinated with *Special Planning of Commercial Facilities*, deepen all service establishments within the Expo Park. If connected with Site Special Design, subdivide the areas in Expo Park into transportation, exhibition, traveling & rest and symbolic features. Design the areas according to different categories. In addition, the urban design prejudices the operation phase from technical angle; especially under the circumstances of lagged planning and operation, the urban design shall be explored ahead of time. What’s more, provide positive suggestions and coordinate & promote the planning and operation.

Finally, the urban design achievement (Fig. 17-18) is brought into a new round of revision of Regulatory Plan, becoming the legal basis (Fig. 19) for enforcement of public statutory general drawing and a variety of technical projects to guide the construction (Fig. 20). This process can be concisely stated as the following three links:

- The Joint Conference System (Fig. 4) set by urban design determines a core entity of close cooperation, which greatly decreases the unnecessary disturbance to design progress and results under the conflict of multiple interest¹⁰.
- Opinions and suggestions of all functional departments are absorbed during the compiling of urban design to revise and optimize the fruit of all special planning¹³. The principle of adaptability for planning is fully implemented.
- Phase results in different aspects of space design, planning operation and construction alteration, etc. are integrated when working out the urban design. If the partition problems of national pavilions with multiple sensitive factors in politics, culture and business are involved, agreement can be achieved through more than ten communications between the Designer and the Exhibition-inviting Department.

Jonathan Barnett brought forward in his *An Introduction to Urban Design* that “urban

design is a process of ‘continuous decision-making’’. The coordination and decision-making mechanism which is hidden behind the design and guarantees the promotion of design and implementation of result is the second connotation of adaptability of urban design.

Indeed, unlike the urban design in general sense, that of Expo Park need not pay much attention to the space, economic & cultural interest of different ranks; however, it is built in a unified problem of urban public interest to consider – this is also the reason why the design of Expo Park is taken as a “Shock Absorber” and dialogue platform of multi-cooperation. Therefore, it is named as “coordinability urban design” by Planner Team.

3.3 Guarantee of Adaptable Urban Design: Operation by One Body and Coordination by Different Departments

Urban design is a systemic and comprehensive project with large span of time and space. It not only relies on all the urban construction but also emphasizes an exit for independent operation in order to avoid responsibility deficiency accordingly. Therefore synergy between the host unit and the co-sponsor exists in all stages of urban design to confirm the interface of uniform planning and dispersive construction and establish a working organization based on systemic research and independent operation, which especially counts.

In the basis of learning from all previous World Expos and combining the existing operation mode of management departments in China, the framework of an Expo Organization, which possesses the functions of both governments (Shanghai 2010 World Expo National Organizing Committee, Shanghai 2010 World Expo National Executive Committee and Bureau of Shanghai World Expo Coordination) and enterprises (Shanghai World Expo Land Holding Limited and Shanghai World Expo (Group) Co., Ltd.), is born at the right moment. The coordination functions of all departments are controlled by Bureau of Shanghai World Expo Coordination which is on behalf of government; while the specific affairs of hosting the Expo are operated by Shanghai World Expo Land Holding Limited and Shanghai World Expo (Group) Co., Ltd. which represent the enterprises. The urban design is sufficiently communicated and interacted between the two, which not only ensures the realization of originality but also the powerful enforcement.

□ As the important fruit participated by experts and the public, the urban design shapes the attractions aiming at the factor of “man”, i. e. the action (accessibility) and mentality (artistic quality) of man, such as “Three Highlights” and “Eight Sceneries”¹¹ brought forward in combination of public space. Finally, the designs of “Mirage Cloud” (Fig. 5), “Eco-River” and “Industrial Heritage” (Fig. 6) are carried out and become innovation of Shanghai Expo.



Fig. 5: Spray facilities in Expo Park



Fig. 6: Pavilion reconstructed from plant in Expo Park

□ As the requirement of attracting investment and exhibition inviting of the World Expo, the urban design takes prejudgment and dynamic interaction. The designers adopt the means of virtual reality to prejudge, with “target” schemes, the project study of “Urban Best Practice Area”, “Expo Village”, etc., which becomes the most convenient and effective communication channel and greatly promotes the competition and selection of multiple schemes in urban design.

□ The exhibition inviting conducted in **2006** meant that **246** pavilions would be

designed and constructed at the same time. Aiming at this highly difficult integration requirement, the urban design developed the Guide of Pavilion Design and Construction to form action framework and instruct & coordinate the design, construction, operation and external building of all pavilions.

With the step-by-step implementation of World Expo planning, a design organization which is synchronously updated and evolved with planning will also head for more complicated networking. The urban designer shall not only complete his own study work but also play the roles of organizer, liaison man, supervisor and coordinator to ensure the enforcement of train of thinking from the Chief Planner team and promote the formation of unified result through sufficient interaction. A kind of urban design mode, which is formed along with the World Expo, adapts to all orders of society, serves as window and link and boasts for theoretical research and practical ability, is named as “Interactive Urban Design” by planner team.

4. The Implementation of Urban Design

During a few months of preparation of urban design and the following 4 years all kinds of special and key plot construction, pavilion construction were pushed forward gradually from the design to construction implementation. With the official opening of Expo 2010, planners are also fortunate to be able to assess the role and value of urban design from the perspective of the implementation.

4.1 Implementation of the protection and transformation of the industrial heritage

In the urban design, guidance are given on the industrial plant function and space utilization of Jiangnan Shipyard, and technical demonstration is done for such transformation, eg: the plant is transformed into large-scale enterprise pavilion, theme pavilions and enterprise joint pavilion; dock and berth is transformed into the recreational facilities, landscape space and the sunken stage, which are derived from the initial design proposal. Here also include: hull combined workshop is transformed into Japanese Industrial Pavilion, joint Pavilion of the Bank of Communications and Cisco enterprise stadium; Western District Assembly and Welding Shop is transformed Footprint Pavilion (one of Theme Pavilions); Western processing plant is transformed into Arts Hall and Expo Museum; and Eastern assembly and welding shop in the heart is transformed the Shipping pavilion (Fig. 7-8).

The effect on the field shows that, the huge spatial scale and scene effects formed by the retention and transformation of plant indeed constitutes a unique style of Puxi Park, and also creates a lot of wind and rain shelter space and provides favorable conditions for the transformed outdoor environment



Fig. 7: the Urban Footprint Pavilion



Fig.8 Shipping pavilion (Nearby, the protection building-translation building)

4.2 The Environmental Capacity Prediction and Countermeasures Deepening

Among the average daily 380,000 visitors forecasted at the Expo, the pavilion and various facilities can only accommodate about 100,000 ~ 120,000 visitors present to observe exhibition at the same time, that is, the visitors will spend 70% of time in the outdoor space after entering the Expo Park. Based on the satisfaction index ,the urban design proposes to

mainly achieve the visitor's sightseeing and auxiliary waiting for visit as much as possible, fully selecting the consumption, food, rest initiative process¹². Thus, urban design focuses on the deepening accounting for the environmental capacity and refines the design of the square system¹³ – dividing into the four-level outdoor space: the entrance and exit square¹⁴, (site level) centre activity square, pavilion waiting square and access. The entrance and exit square mainly serves for the traffic easing and integrated services (Fig. 9); the centre activity square stress location feature and it is used for the theme interpretation and image landmark (Fig. 10); the pavilion waiting square is used to meet the visitor's needs of outdoor show, rain shelter and rest and food, to which (Fig. 11); general access is the basic space of the visitor flow fast and safe passage (Fig. 12).

From the view of scene effect, at the Puxi Park, hot spots are distributed more balanced because of moderate size, and the actual use effect of the square is better than that of Pudong Park.



Fig.9 Square within the entrance and exit of South Xizang Road, Puxi Area



Fig.10 Activity Square at Zone D, Puxi Area



Fig.11 Waiting Square at Theme Pavilion



Fig.12 Elevated pedestrians' walk at Puxi Area

4.3 The Humanistic Design of Outdoor Space

The urban design proposed that the outdoor public space should not only include the passive activities such as lining up, waiting and evacuation, but also should include the initiative activities such as viewing, rest and communication.

From the opening of the Expo in 55 days, the site effect shows that what the visitors complain most is the problem of waiting. Many pavilions at Pudong fails to built the adequate shield and rest facilities at the queuing area by Urban Design Guidelines, which let the waiting become a torment (Fig. 13). The Enterprise pavilions at Puxi well follow the four elements of this guidelines: sun ventilation, multimedia presentations, service staff interactive, seating and other humanistic facilities, of which , Shanghai Corporate Pavilion is the best (Fig. 14). In addition, the elevated pedestrians' walks create a large-scale shelter space in the Expo Park, achieving the desired design objectives (Fig. 15-16).



Fig.13 Saudi Pavilion lack of sufficient and pleasant waiting space



Fig.14 Shanghai Corporate Pavilion floor overhead waiting area design



Fig.15 Rest space under the elevated pedestrians' walk



Fig.16 Waiting space under the elevated pedestrians' walk

5. Conclusions

Urban Design rich in the design method with growth property actively looks for the effective meeting point of interests of all parties, builds the action framework for construction and implementation, and provides technical support for management organizations to make it tend to Policy-Oriented Process with focus on overall coordination and adapting to the change.

Expo Urban Design as one “bounded rationality” stage achievement, the key to success lies in its adaptability, namely, the establishment of adjustable feedback mechanism—through constantly running in the difference between reality and ideal so as to achieve the self-improvement and advance of the planning and design. In such process, the specific practice is transited from the emphasis on space results to on the implementation of organization demonstration; technology approach is shifted from professional design to the integration of government action, business operations and activity organization; its achievement is also expanded to the comprehensive control approach for the policy and decision-making from the shape proposal. The “participation in multi-form and team decision-making” in the process makes it have this capability, and become one of the organizational designing strategies at the background rapid development of globalization. From this point, it is also one of the fundamental of “harmonious city” which the Expo needs to build.

Notes

1. Including a total of 18 planning such as electricity, postal services, sanitation, energy, roads, tunnels, docks, fire fighting, transportation, flood control, communications, plumbing, logistics, civil defense, medical, security (counter-terrorism), environmental protection greening and exhibition (exhibition ancillary facilities);
2. Including Shanghai Tongji Urban Planning & Design Institute、Shanghai Urban Planning & Research Institute And East China Architectural Design & Research Institute ;

3. Since the International Competition in 2004, Expo Park Planning has experienced the competition program integration, structure and General Plan, Regulatory Plan preparation. See: Zhou Jian. Expo Planning between Ideal and Reality—Analysis on the Evolution of Planning of the Expo 2010 Shanghai China [J]. Planners. 2006.7:34-38;
4. Shen Di, Orientation and Meaning of Urban Design of the Expo Park [J]. Planners. 2006.7:26-27;
5. On August 19, 2006, the construction of Expo Park officially started and 11 roads such as Puming Road firstly started at Pudong area;
6. Zhang Weili, Building a Harmonious World Expo Infrastructure [J].Planners. 2006.7:29-30;
7. In late 19th and early 20th century, the adaptability theory began being widely applied to the study of geography and anthropology. Adjustment Theory in the Geography is also called coherence theory, which was first established by the British geographer P.M.Roxbz in 1930. This theory is cited into the planning disciplines, that is, establishment of the adjustable feedback design organization system with the overall and dynamic concept regulatory;
8. In 1923, the United States geographers H.H. Barrows proposed the concept of human ecology, advocating a view of human adaptation to the environment to coordinate the mutual relations among the resources, environment and development;
9. Including the existing land composition table, table of plot control elements, road control breakdown, etc.;
10. "Urban Design Joint Conference System" is lead by the Bureau of Shanghai World Expo Coordination, of which, chief planner is the Chief Technical Advisor, and the design units carry out the work summary and discussion. The main design units, including Shanghai Tongji Urban Planning & Design Institute and East China Architectural Design & Research Institute;
11. In the late Urban Design, the design results of theme interpretation and planning include: three highlights at the Expo Park o: "Harmony Landmark ", "Global Rainbow" and "Huangpu River Canon"; and Eight Scenery reflecting the style characteristics of each functional block " : "Bridge of Dream", "Eco-River," Theme Pavilion"," Urban Trend", "Industrial Heritage", "Mirage Cloud"," Metropolis Avenue "and "Sky Walk";
12. Zhang Ying and Yu Jing, Interactive Open Space Design—Study on Plaza System Planning of Expo 2010 Shanghai China [J]. Planner. 2006.7:51-53;
13. In the green space planning system, summarize the square and green land to the unified system with the greening rate of 50% as a cutoff point; the site of greening rate $\leq 50\%$ shall be square; according to this, measure the total



Fig. 17: Urban Design of Puxi Area

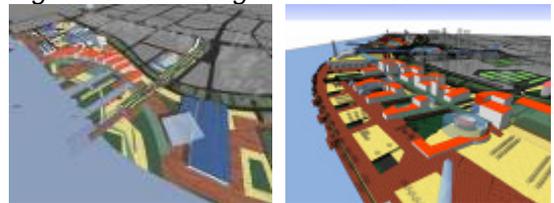


Fig. 18: Urban Design of Puxi Area



Figure 19: Plan Adjust based on the Urban Design of Puxi Area



Fig. 20: Aerial map of Puxi Area

size of the effective services of all outdoor public space (green land, squares, roads, platform, etc.);

14. In the square at the entrance, outside square is not included in the balance sheet of fence land;
15. Zhuang Linde, Zhang Jingxiang, *China's Urban Development and Construction History*, Nanjing: Southeast University Press. 2003.11 : 262;

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