

The Evaluation and Improvement Method of Waterfront Urban Landscape: the Case of Urban Landscape Planning for West Lake in Hangzhou, China

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Abstract

Urban landscape usually contains two layers of meaning: landscape and viewing, especially in waterfront zone. Traditional design focuses on landscape design which purely improve the quality of objects in static, passive way much more than noticing the initiative viewer as subject. Actually, landscape and viewing are dialectic. Interactive design using reasonable visual evaluation methods, integrated with “positive” human activity optimization as well as “passive” landscape improvement, can be helpful to enhance the quality and controllability.

West Lake in Hangzhou is the famous cultural heritage in China with humanities and nature fitting each other perfectly, which also represents the model of blending natural scenery and modern city. However, it faces some urgent problems in modern urban development, the relationship between West Lake and the city has become extremely uncoordinated, as it suffered very serious “pressure” from the city.

This paper takes West Lake as example, basing on lots of survey, analyzes the visual effect from every grid viewpoint on the lake (using GPS to locate), and tries to find out the both way of adjustment from the respects of viewer and landscape, and finally proposes some thinking of the design method.

Being water-adjacent is one of the critical principles for ancient cities. In contemporary city, although the functional factor has gradually declined, the landscape meaning is getting greater. People are enabled to comprehend a city in a panoramic way at an open waterfront zone, which can improve the quality of the city. As so, the relationship between the urban and the water landscape is a fundamental issue for the urban construction.

When considering urban and landscape, people usually treat them as two separate objects simply collaged. Researchers seldom focus on the interaction of the two parts as well as the value based on this, and the following strategy is hence ignored. This paper takes West Lake in Hangzhou as example, tries to find reasonable, simple, universal methods to solve the “landscape oriented” urban design issues.

1. Background

1.1 Urban Waterfront Landscape

Urban waterfront can be divided into two types: one is inside the urban area as a planar

element, like West Lake in Hangzhou, Xuanwu Lake in Nanjing, while the other goes through the urban as a linear element, like Qinhuai River in Nanjing, Grand Canal through many cities. The former one can form a panoramic view of the city; the latter one is more tend to be landscape belt. In comparison, the open water body is more valuable for urban landscape.

Though there are mature principles for the waterfront space design, like building setback distance, height and massing control of the buildings near the shore, have guaranteed the basic quality of the environment, the shape and scale of the water vary as well as the relationship between city and water, that can deeply influence the viewer. If open waterfront zone boasts multiple public sight-seeing points, people can read the city's skyline from different places, at different angles, it would be easy to establish the impression of the whole city.

Due to the integration of the architecture and landscape discipline, architects began to draw the overall thinking into detailed architecture design: the impact of new construction in the built environment, the way of coexisting, the design strategy in visually sensitive zones, the use of computer technologies to simulate the building volume, the visual sequences and landscape effect at key viewpoints. A series of analysis on the massing, height, façade, top and the whole outfit have accelerate the rational of the design.

Overall thinking is good for architecture design in some levels, but not enough for the large scale of the city, especially at panoramic waterfront zone, which might emerge the problem of "entirely mess, partially ordered". So, besides discussing possibilities of the design, the evaluation should get rid of architect's personal preference, judge objectively through scientific method and public participation, and finally achieve the adjustment and control.

1.2 Evaluation Methods

Hangzhou is outstanding among cities boast large-scaled waterfront in China, and so is West Lake in Hangzhou. It has experienced both natural and man-made evolution through thousands of years, with great crystallization of mild temperament and cultural allusions, which is the best representation of Hangzhou. But, this characteristic has faced some challenges in modern development. The lake opens up to the city so straightforwardly that increasing high-rise buildings and rising height expose directly without any cover. The well-proportioned skyline has turned into a stiff wall rapidly, and has replaced the lakeside kind of feeling. West Lake has suffered the pressure coming from the city, very seriously.

The landscape planning contains two processes: evaluation as approach and control as result. Both of them will divide the landscape into initiative viewing and passive objects. Initiative viewing focuses on the variety and sensibility, while passive objects emphasize on reality. According to the difference of the evaluation and control, evaluation mainly discusses people's initial feeling as visual subject, while control prefers improving the quality of the landscape based on the conclusion from people.

2. Evaluation methods

According to general rules of landscape viewing behavior, the viewer and landscape are two basic elements. The viewer stresses the viewpoints, route and the psychological feeling, the landscape stresses the value and significance of every constitute unit of the landscape.

2.1 Evaluation of the Viewer

Chinese researchers have proposed many analysis modes: aesthetic mode, ecological mode and so on. So far, researches are normally qualitative description, lack detailed method for some special condition.

1. Categories of viewpoints

West Lake is famous of “being surrounded by hill at three sides and city at one side”. It’s 3200 meters from south to north and 2700 meters from east to west, with 5.6 square kilometers of water area, surrounded by hill at south, west, north direction, and city at east. The Baoshi Hill (BaoChu Pagoda) and Wu Hill (ChengHuang temple) are the borders of the “stage”, the distance between them are the visible urban landscape. The Su Causeway, the Bai Causeway, Gu Hill, Isle Mid-lake Pavilion, Ruan-gong Isle are the most important public space and viewpoints. (Figure 1)



Figure 1: Visible Area from West Lake

We classified the viewpoints into three types according to the sightseeing activity: spots, linear and planar. Spots are usually at dominant height or can get special experience, there are two spots in West Lake: BaoChu Pagoda and ChengHuang Temple. Linear points are a series of points along people’s route, which can provide continuous visual experience and change with people’s movement. Su Causeway and Bai Causeway are typical linear points. Planar points are multiple ones in a larger area yet have little difference. Since the lake locates on one side to the city, people’s activity on the lake can be divided into several large areas.

On the other hand, people’s activity has two types of static and mobile. When people stand still at some relatively stable point, the feeling is independent and unique. Good static viewpoint is favorable for landmark buildings. Mobile viewing means people formed the perception during the moving, overlaid multiple urban landscape façades and finally got the whole impression. It is always related to the linear and planar points, continuous movement and visual overlying is the basic feature. During the route, special spot in mobile process equals static spot.

2. Evaluation methods

We took many ways to collect the performance of urban landscape as follows:

1) Questionnaire. We collected opinions of different groups (ages, nationalities, education levels) by questionnaires and interviews randomly along the Su Causeway, at “Ten Scenes”

and boat docks. The questions involve selection of viewpoints and route, landscape nature and feelings, architectural features and details, the overall impression and evaluations. All withdraw 100 valid questionnaires, of which 80 were Chinese, and 20 were English copies.

2) Viewpoint marking. During the continuous scene, mark out the best, the worst, sudden change spots with explanation and illustrations. We chose the Su Causeway and the Bai Causeway as the route, started from the south of the Su Causeway, walked forward north, bypassed Gu Hill, until the east end of the Bai Causeway, marked out 22 spots with photos and writing.

3) Pictures and records. This is the most direct way to record the real situation of the landscape at every special spot. The broad lake is a typical planar spots assembled, on which paddleboats can cruise randomly. We put a grid on the lake, which is 250 by 250 meters in north-south direction, numbered every intersection point, then used the GPS to locate, took multi shots at every point that can merge into a panoramic view of the city from this angle. We got 130 valid photos, 120 of which were used. (Figure 2) Through the methods above, most of the viewpoints have been covered, around and in the lake.



Figure 2: Photos from Three Viewpoints

2.2 Evaluation of Landscape

The evaluate object is the elements that form the urban landscape, such as buildings, trees and so on. Although visual effect is a subjective concept, there are some general aesthetic standards and common sense that can be quantified.

1. Single element

Urban landscape is formed by many elements, which contain manmade elements like architectures, sculptures, bridges, and natural elements like mountain, water and trees. For West Lake, manmade elements are dominant and important for the visual effect, especially when the buildings are continuous background. Since high-rise buildings determine the quality of the skyline, we defined the visible area in depth of 9 km, evaluate every high-rise building in this area from the aspects of height, scale, façade, top feature, material and distance from lake shore. According to the principle of coordination with the surrounding, we picked the best 5 buildings from the total 70 ones: West Lake culture center, Xinqiao Hotel, China Bank, Hangzhou Friendship Hotel and ZJCOF (Zhejiang Cereals, Oils & Foodstuffs Import & Export Co., Ltd).

2. Group elements

The skyline and layers mainly show the group performance. Since the center of the city keeps changing, land developing intensity increasing rapidly, the quantity and height of the buildings

being break, the overlap situation has been serious in recent years, the vacant has been gradually filled into a “wall”.

The rigid surface and the same height result in the monotonous façade, and the variety and value have been weakened. So, in order to get good visual effect, the skyline and subjective experience are the key points.

The skyline is one kind of special impression of the whole city, formed by the high-rise buildings. A good skyline needs appropriate fluctuation, landmarks at exact position, and natural link between city and nature. We graded from the unit density, unit area range and unit First height Difference. The higher density is, the less obvious rhythm; the greater area range is, the better identifiable is; the higher difference is, the more obvious fluctuation is.

The subjective experience judgment is from the buildings’ layers, color and visual patch, in detail, the substantial degree of layers, area proportion of manmade and nature, and color coordination. The variety and color coordination are correlative to the quality, the higher the better, while the area proportion of manmade and nature is inverse correlative, the less the better. (Figure 3)

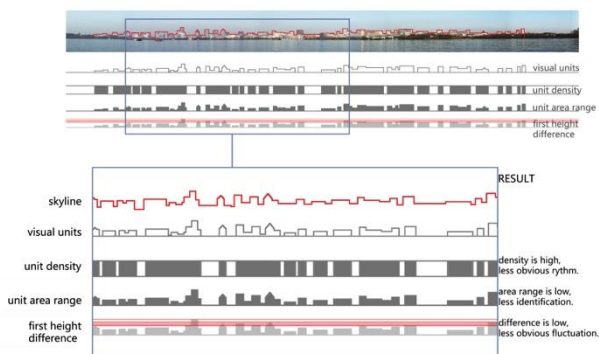


Figure 3: Skyline Analysis

2.3 Relationship between viewer and landscape

In the actual process, the evaluations of the two parts happen simultaneously. People are subject; landscape is object, by the medium of viewer. A complete process can be described like: people stand at some point (or along some route), use the methods of viewing judgment, make evaluations of the landscape. So, they are not isolated but relying on each other. If analyses “point” without “landscape”, it’s prone to over-emphasize the subjective choice, if judge the “landscape” without “point”, it will be unpractical in built environment.

The comprehensive evaluation is based on the data synthesis and screening, the evaluation of the landscape is quantities, hence treated as the basic conclusion, while the evaluation of viewer is qualitative, and treated as the adjustment suggestion.

But the conclusion is not a precise score, especially when the viewpoint’s choice is quite subjective, so we add the questionnaire some descriptive expression, such as “ the visual quality at the YaDi Bridge is pretty good, 85 score”, “ when I row a paddleboat moving from north to south, the whole landscape is getting better”, “I think the landscape west to the ‘Three Pools Mirroring the Moon’ is much better than the east part”.

3. Methods of control

3.1 Improvement of viewpoints

During the process, we graded 102 photos and classified them into 4 levels: the first class is the best 23 viewpoints, scored 80-90, the second level is 13 points which are 60-79, third is common points, 48 ones, which are 30-60, the fourth is the worst 18 ones scored 10-30. All these points are scattered in three types (spot, linear, planar). Among “Ten Scenes”, “Spring Dawn at Su Causeway”, “Orioles Singing in the Willows” and “Leifeng Pagoda in Evening Glow” are better than “Autumn Moon Over Calm Lake” and “Lingering Snow on the Broken Bridge” that are closer to the urban façade. Respectively, Su Causeway is far from the façade, with “Isle Mid-lake Pavilion” in between adding the layers of the landscape, is much better than the Bai Causeway. On the lake plan, the area east to the Isle Mid-lake Pavilion is the worst at all, for there is no any block or landmark. (Figure 4)

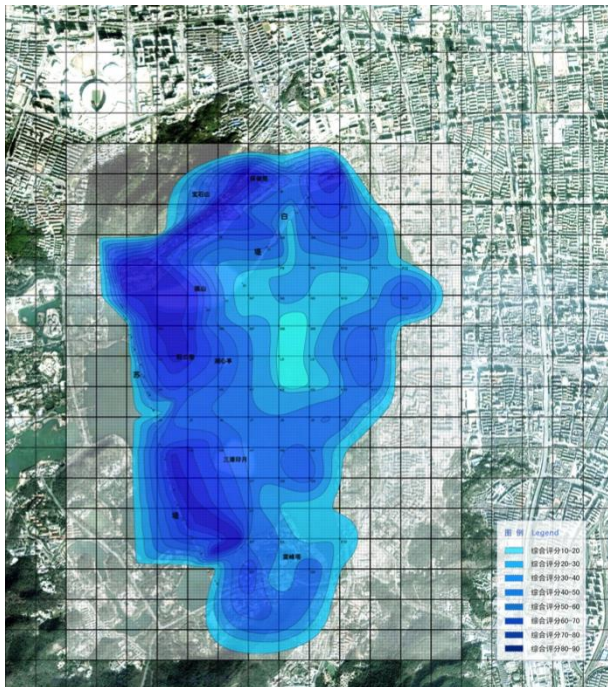


Figure 4: Scores of all Viewpoints on the Lake

Through the analysis, we proposed the improvement strategies:

1. Avoid negative viewpoints (spot aspect). Viewpoint is unit of the system, numerous points form routes. The quality of the points decides the whole effect. In fact, most of the “Ten Scenes” face the urban façade directly, so when the façade is not good enough at some spot, the spot should be avoided. For example, “Lingering Snow on the Broken Bridge” should increase the probability of XiLi Lake on the other side of the bridge. “Leifeng Pagoda in Evening Glow” should guide people to overlook the Su Causeway. “Orioles Singing in the Willows” could shift the focus to the “inland” activities like jogging. “Breeze-ruffled Lotus at Quyuan Garden”, “Three Pools Mirroring the Moon” and “Viewing Fish at Flower Pond” should improve the tour line and environment inside the scenic area rather than outside.

The viewpoints along the shore need different approaches to optimize: poor ones could take advantage of adjacent landscape to attract and transfer people’s interest, such as willow

shadow effect can block the lake and city landscape but emphasize the depth of the shoreline, while excellent viewpoints should increase opportunities and space for tourists to stay.

2. Update cruises on the lake (linear aspect). There are 4 terminal docks located at the south and north end, and 1 transfer dock at the “Three Pools Mirroring the Moon”. The exist cruise are 5 lines: “Three Pools Mirroring the Moon” – Su Causeway, “Three Pools Mirroring the Moon” – Lake Shore park, Lake Center Islands – Gu Hill, “Three Pools Mirroring the Moon” – YongJin Dock, HuaGang Dock – “Three Pools Mirroring the Moon”. This means 60% of the cruises go across the worst area. So, under the premise of not changing docks and sight attractions, we change the shape of the cruise line to avoid the worst area: in regard to the cruises via central islands, move the stops from the east side to the west, in regard to the cruises toward the eastern shore, move the stops towards natural section of the bank, where trees can cover the high-rise building far away. (Figure 5)

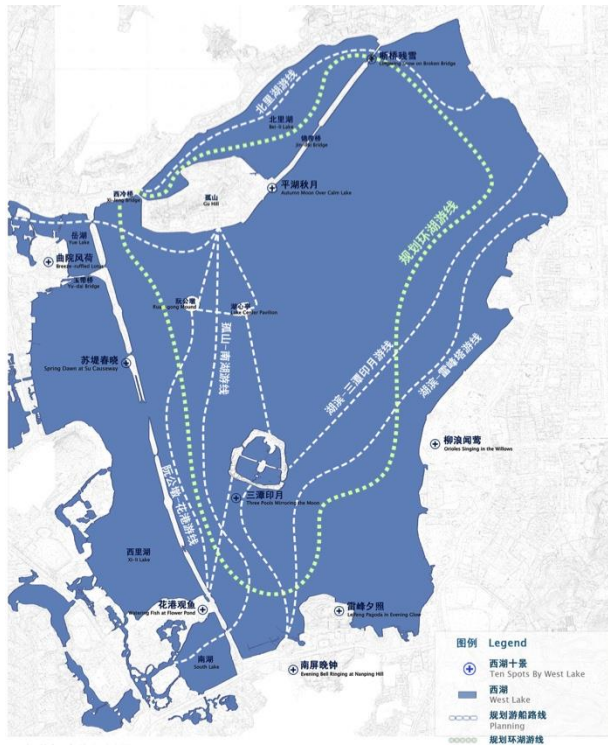


Figure 5: Adjustment of Cruises on the Lake

3. Choose good view surface (planar aspect). On the lake, the area east to the Isle Mid-lake Pavilion is the worst, followed by northern part, and the southern is the best. The visual quality is related to the shape of lake itself and relative position with the urban façade. Medium and close landscape are very effective in improving the panoramic scene, so, marking out the best surface is also a positive countermeasure. According to the questionnaire and photo scoring, the Su Causeway and “Orioles Singing in the Willows” section are the best surface for panorama.

3.2 Improvement of the urban landscape

Since the urban landscape is the appearance of the buildings' organization, improvement should pay attention to the spatial structure and form.

1. Urban center system adjustment and overall layout planning

This strategy is based on the overall planning of the urban structure. High-rise buildings are mainly distributed in Wulin Square, Qinchun Road, Station District, Qianjiang New District, Binjiang New District. In the next 20 years, Qianjiang New District is the direction of the development, which means more high-rise buildings will appear in the façade. According to the data calculation, Hangzhou's urban center system would become a continuous one connecting five sub-systems into one. But this doesn't allow the random grow. High-rise buildings should be well placed, not only in plan, but also in elevation, not only in new district, but also in old area. From the perspective of "viewing city from lake", if the buildings perpendicular to the façade can "form skyline fluctuate in rhythm and combine landmarks at multipoint, the façade would be worth viewing. So, we prefer the "two cores and four sub-cores" spatial system: Wulin Square as traditional commercial core and Qianjiang New District, each represents the north and south develop center of the city, four sub-cores locate around and between. When people see the urban façade at any point from the lake, the skyline will appear multi combinations. (Figure 6)

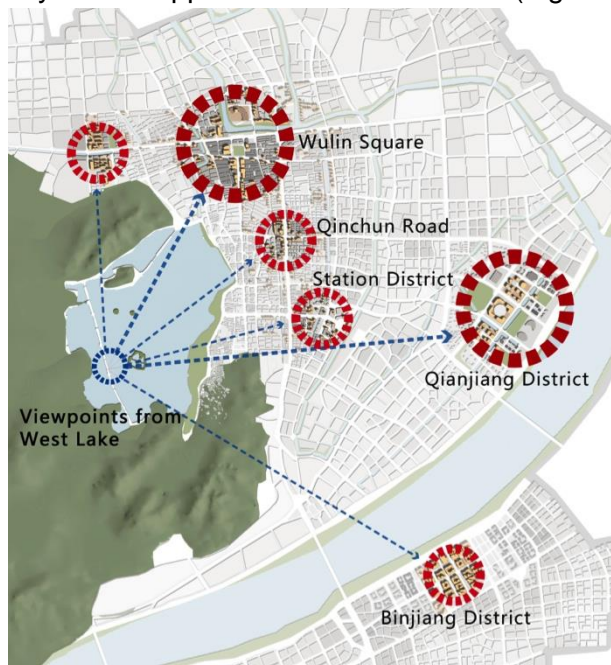


Figure 6: Urban Center System Structure

Besides the adjustment of the layout, the height control is another critical method. We numbered every block in the visible area, picked out the buildings higher than 8 floors and 32 meters, established corresponding data files (property, location, floors, color, material, top, photo), overlaid the atmospheric visibility that reduce along the distance, finally got the lake-centered visible cambered area data base. The concentric spheres are circled with the Su Causeway, radius as 2 km, 3.5 km, 6 km, 9 km separately, corresponding to lakeside house, Qinchun Road, Station District, Qianjiang New District. Ideal skyline shape helps us decide the height upper limit for each stage: 32 m, 100 m, 150 m, 200 m. 70% buildings must be within the height, between 50%-70% of the figure, in order to attain the safe pattern of the spatial structure and landscape (basic requirement), afterwards, the buildings in "two cores and four sub-cores" need some adjustments according to the whole three dimension effect. The entire east coast city is divided into 18 control zones by this mode, with the urban plots

fully covered. Buildings' height limitation within different plots provides the basic framework and platform for the future management and control, and connects with the next level of urban design work well. (Figure 7, Figure 8)



Figure 7: Safe Pattern of the Urban Spatial Structure

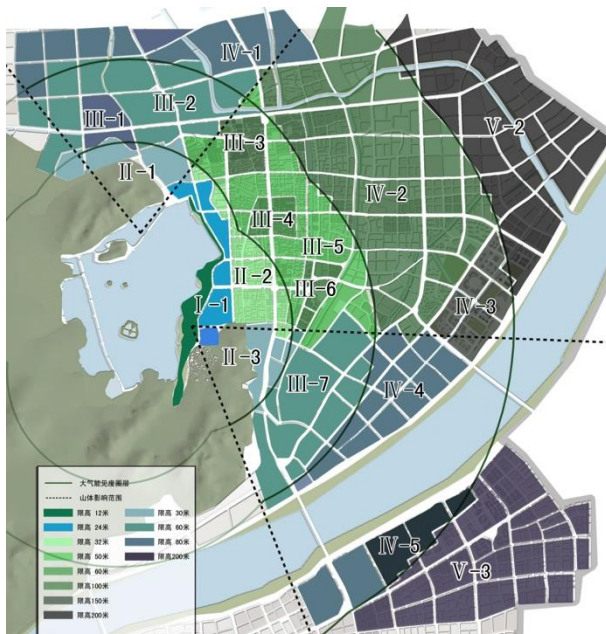


Figure 8: Height Control of 18 Plots of the Visible Area

2. Improvement of single buildings

Improvement of buildings is mainly on the exterior. We chose the feasible aspects of top improvement, façade improvement and greening: rectification of the "temporary shape" and advertising boards at the high-rise buildings' top, reduction of conflict with the built environment by choosing materials and colors according to the building's status in the whole façade, greening on the annex platform for increasing the variety of the base level. Then, we picked 25 single buildings to carry out the plan.

3. landscape supplement in lakeside

Lakeside space has special value for it can provide a relative separate surface for landscape viewing yet blends the lake and shore into one, the design of the space can not be neglected. Among the photos, we found that all the points where photos contain Isle Mid-lake Pavilion, Gu-Hill or tortuous shorelines, the point must be above second level. Because of these natural elements attract people's interests, the urban landscape easily get blurred and out of focus. For its property as the boundaries of urban landscape and as the edge of the lake landscape, we proposed two ways of supplement: urban interface fix and lakeside landscape construction.

As the start of the landscape, lakeside should link with the urban in a natural way, from the height, massing, shape, style. Buildings should lower than 12 meters, in simple style and small scale, just for adorning the shore.

In tourists' opinion, the lake is broad lacking of focus, but the shore is rich of all kinds of plants and furniture, so they prefer the pavilions and trees to the lake. In so, the arrangement of the plant should correspond to the landscape, tall trees at surface needs shelter, low shrubs at surface needs opened up.

4. Conclusion

1. Characteristics of the city need to be shown by representative of culture or landscape, commonly referred to as "special culture" or "characteristic landscape". In the context of urban landscape increasingly following the same pattern, protection and inheritance of landscape, publicity and highlighting of cultural characteristics, is an important measure in enhancing the quality and content of the city. But more important is to find a balance between conservation and construction, to seek reasonable remodeling methods, to create a dynamic, competitive environment full of human temperament.

2. "Landscape + View" two-way adjustment for urban landscape visual evaluation has multiple effects. Conduct reasonable route guidance and viewpoint choice from the "View" perspective is what urban design has done: closely integrated design with people's feelings. While actively respond to the plight of urban construction, and reflect on foresight idea, which is helpful to establish scientific platform enables the control and management of urban landscape operate more rationally.

3. Visual evaluation remains some deficiencies. First, landscape planning based on visual assessment can not independently solve all problems, let alone replace the overall urban planning, but needs support from other assessment methods and planning results. Secondly, "visual evaluation" as the name suggests, is landscape environment evaluation in accordance with personal visual aesthetic standards. We followed the planimetry perspective rule, but when groups of people work together, because of the difference of standard and personal preferences, may cause bias in terms of accuracy and scientific aspects, to be further improved. Thirdly, the interviews have a strong "personal touch", the number and the level of participants directly influent the accuracy and objectivity of the "conclusion", therefore, the set of the interview questions, organization of programs are particularly important.

(Project Cooperation: Wang Jianguo, Yang Junyan, Chen Yu, Xu Ning, Liu Di, Zhao Ye, Kong Xiangheng, Yang Yang.)

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Appendix

Ten Scenes of West Lake:

1. Spring Dawn at Su Causeway
2. Autumn Moon over the Calm Lake
3. Viewing Fish at Flower Pond
4. Orioles Singing in the Willows
5. Three Pools Mirroring the Moon
6. Twin Peaks Piercing in Cloud
7. Evening Bell Ringing at Nanping Hill
8. Leifeng Pagoda in Evening Glow
9. Breeze-ruffled Lotus at Quyuan Garden
10. Lingering Snow on the Broken Bridge