刊首语

将韧性作为设计的驱动力

金华白沙堤三十六堰灌区在2020年成功入选世界灌溉工程遗产名录，是浙江省现存最古老的堰坝引水灌溉工程，始建于27年。灌溉农田达1.86万 hm^2，从最上游沙贩堰到最下游中济堰，横跨45 km，水位落差168 m。三十六堰的建设依循“阶梯－深潭”山区河流自然发育的地貌特征，在每个深潭的下游修筑堰坝，利用深潭对水流的消能作用以减小对堰坝的冲击，稳定了白沙溪的河床，并在干旱月份增加堰坝蓄水量。同时，“以潭筑堰”的方式有利于生物多样性保护，有极高的区域生态重塑价值。不同于建设刚性大坝的方式，三十六堰更加因地制宜，以低影响介入、刚柔并济的方式多级修筑堰坝，构建了持久的区域韧性系统，彰显了传统智慧。

在前工业时代，以农业、水利为基础，构建了很多辐射区域的灌区，形成了与自然相适应的基础设施体系，支撑区域内城市和乡村的发展。随着工业化转变，城市人口高度聚集和城市蔓延，快捷方便的基础设施网络迅速与区域的工业化生产交织，促进城市化发展并显著地改变着景观风貌。

工业革命产生总是与城市的发展息息相关，英国如此，法国亦如是，在拥有更多土地的美国，这一特征更加明显。产业革命使劳动力聚集，推动了美国城市体系的形成。作为美国工业化程度最高地区之一的波士顿查尔斯河口，河口沿岸在1820年前还是潮汐盐生沼泽湿地，每天要经历2次涨潮期。为利用潮汐水能，在沿河的波士顿公地（Boston Common）和后湾（Back Bay）建立了呈“T”形的长、短两座拦水坝，并和砾石角（Gravelly Point）相连，这里设有用于工业及纺织业生产的轧机滚轮，两座坝将潮汐沼泽地带分为水位不同的2个盆地。在涨潮时通过长拦水坝（Mill Dam）闸口进入高位盆地，当蓄水达至设定水位时，通过短坝（Cross Dam）上的闸口泄入低位盆地，再排入查尔斯河，水流在此过程中带动轧机滚轮进行24 h持续转动，有效利用这一自然力量，提高了生产效率。这项建坝工程促使波士顿成为工业中心，但同时也改变了查尔斯河口的潮汐沼泽生态环境，拦水坝阻挡了潮水对沼泽地带的清洁作用，长期积聚的工业废弃垃圾使此地变成泥泞地带，降低了水在盆地的流动速度，导致轧机滚轮无法运转。至1850年，城市转型已经成为城市化过程中亟待解决的问题。后湾填地项目在诸多因素的助推下应运而生，使污染的河口地区环境得到治理，波士顿半岛的面积得到扩张，原有潮汐沼泽湿地区建设了后湾商住城市片区以及波士顿公共花园，修建联邦林荫大道，进一步提升了后湾土地价值，联邦林荫大道也成为未来波士顿“翡翠项链”连接波士顿公共花园和波士顿公地的重要绿道。

然而，后湾填地工程降低了汇入后湾的泥河（Muddy River）的行洪能力，为城市西南地区带来潜在洪水风险，奥姆斯特德将泥河的弹性防洪功能与外围泛洪区相结合进行公园设计，并整合下水道、水闸等工程措施共同解决洪涝风险。至此，一个原本土地局促的河口半岛得到充分拓展，原始景观发生了极大的改变。持续的工程建设促进了城市应对不同时期风险的适应性转型发展，形成了公园与防洪工程相融合的韧性基础设施体系。

当代城市形态是基于工业化社会运转需求形成的：发达的基础设施网络、生产厂房、办公区、住宅以及相应的休憩绿地。现代基础设施的优势在于强调效率和经济的标准化建设，但同时也暴露出在应对灾害和意外事故风险方面的脆弱性，缺乏弹性和适应能力。

在后工业时代，支撑工业化生产运转的城市形态必然会有新的演进，我们有必要重新思考基础设施应对灾害风险和重塑公共空间的新路径。区域的发展与人们的生活总是需要应对灾难，并适应不断变化的外在环境，然而实际上涨潮、洪水、飓风都只是自然现象，本身并不是灾难，如何通过设计手段提升应对风险能力才是我们的课题。在全球气候变化、碳中和、数字经济的发展背景下，将韧性作为设计的驱动力，重新认知自然，认知传统，通过将刚性的抵御与弹性的应对相结合，修复受损的生态系统，重塑公共空间，共同构建更安全、更有趣和更具活力的城市。

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PREFACE

With Resilience as the Driving Force of Design

Weir 36 Irrigation Area of Baisha Dike, Jinhua, was successfully included in the World Irrigation Engineering Heritage List in 2020. As the existing oldest weir diverting water for irrigation in Zhejiang Province, it was established in AD 27. The weir may irrigate 18,600 hm^2 of farmland across 45 km from the most upstream Shafan Weir to the most downstream Zhongji Weir, with height of water 168 m. The construction of the Weir 36 follows the geomorphic characteristics of naturally developed mountain rivers of "terraces-deep pools". A weir was built downstream of each deep pool to reduce the impact of the weir using the energy dissipation effect of the deep pool on the water flow, thus stabilizing the bed of the Baisha Creek, and increasing the water retention capacity of the weir during the dry months. At the same time, "building a weir by deep pool" is conducive to biodiversity conservation with a high value for regional ecological restoration. Different from a rigid dam, Weir 36 is more suitable to local conditions in construction mode. A durable regional resilience system is constructed using a multi-stage construction of weir by low impact intervention of both resilience and rigidity, reflecting a traditional wisdom.

In the pre-industrial times, many radiating irrigation areas were constructed based on agriculture and water conservancy, thus forming an infrastructure system adaptable to the nature, which supported local urban and rural development. With the urban population highly concentrated and urban sprawl following industrialization, infrastructure networks have intersected with local industrial production quickly and conveniently for promoting urbanization, which is changing the landscapes dramatically.

As with Britain and France, industrial revolution has always been closely related to the development of cities. In the United States with more land, this is more evident: the industrial revolution has concentrated the labor force and promoted the formation of the American urban system. The Charles River estuary in Boston, as one of the most industrialized regions in the United States, was a tidal salt marsh with two high tides a day until 1820. In order to utilize the tidal power, T-shaped long and short dams (Mill Dam and Cross Dam) were established at the Boston Common and Back Bay along the river, connecting the Gravelly Point, where there were rolling mills for industrial and textile production, and two dams dividing the tidal swamp into two basins with different water levels. At high tide, water access to the high basin may be realized through the gate of long dam (Mill Dam), and when the set water level was reached, the water was discharged to the low basin through the gate of short dam (Cross Dam), and then into the Charles River. In the process, the water flow drove the rolling mill roller to rotate continuously for 24 h. This natural force was utilized effectively, and thus, the production efficiency was improved. This dam project made Boston become an industrial center, but at the same time, it changed the tidal marsh ecology at the Charles River estuary. Specifically, the dam for water retaining prevented the tide from cleaning the swamp, and the accumulated industrial waste turned it into a muddy zone, slowing the flow of water through the basin, and thus, the roller of rolling mill became unable to operate. By 1850, urban transformation had become an urgent problem to be solved in the process of urbanization. Back Bay reclamation project was initiated under the boost of many factors. Subsequently, the polluted environment at the estuary was brought under control, the area of the Boston Peninsula was expanded, and in the original tidal marsh, the Back Bay Commercial and Residential Urban Area and the Boston Public Garden, together with Commonwealth Avenue, were built. The land value of Back Bay was further enhanced, and the Commonwealth Avenue became an important green way for "Emerald Necklace" of future Boston connecting Boston Public Garden and Boston Common.

However, the Back Bay reclamation project has reduced the flood carrying capacity of the Muddy River, which flows into the Back Bay, thus posing a potential flood risk to the southwest of the city. Olmsted combined the flexible flood control function of the Muddy River with peripheral flood zones as designing the park, and integrated sewers and sluices for addressing the flood risk. Thus, an estuarine peninsula with limited land was fully expanded, and the original landscape was changed greatly. The continuous construction has promoted an adaptive transformation of the city to cope with risks in different periods, and formed a resilient infrastructure system integrating parks and flood control works.

Contemporary urban is formed based on the demand of an industrialized society for functioning: developed infrastructure network, production workshop, office area, residence, and corresponding open green space. For modern infrastructure, there are advantages lying in an emphasis on efficiency and standardized economic construction, but there is vulnerability in responding to disaster and accident risks, and lack of resilience and adaptability as well.

In a post-industrial era, there will inevitably be new evolutions for an urban form supporting the operation of industrial production, and so, it is necessary for us to rethink a new path for the infrastructure to cope with disaster risk and reshape public space. For regional development and people's life, there is always the need to cope with disasters and adapt to changing external circumstances. However, as a matter of fact, high tides, floods, and hurricanes are just natural phenomena, not disasters in themselves. What we need to do is promoting our ability to deal with relevant risks. Under global development background of climate change, carbon neutral, and digital economy, with resilience as the driving force of design we can repair damaged ecosystems, reshape public spaces, and make our cities safer, more interesting, and more vibrant jointly through combining rigid resistance with resilient response.

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