Chapter 7
Unrelenting Change

Peter Bosselmann, Mathias Kondolf, and Jiang Feng

Abstract This chapter revisits the locations of six urban design proposals in the Pearl River Delta that were completed and presented to decision makers. Starting in 2007, proposals were completed with successive groups of young design professionals from the University of California at Berkeley and the South China University of Technology in Guangzhou. Our work over the years addressed two major regional concerns: water management strategies in low-lying delta communities and design proposals to counter-displacement of residents forced out by large-scale land redevelopment processes. The first concern led us to design strategies that address tidal and riverine flood risks when combined with seasonal monsoon events; the second concern addressed the social and economic future of residents in rural and urban communities by proposing small-scale community-driven responses versus medium to large-scale land re-adjustments that became typical in the fast-growing delta region since the 1980s. In evaluating our past work, we compare and analyse present conditions at six locations. The conclusion of our analysis points to the fact that our work over the years has reduced some of the potential harm to communities, but that only more deliberate planning decisions could produce sustainable solutions in the long term.

Keywords Urban design · Water management strategies · Design explorations · Landscape transformations

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7.1 Introduction

When China opened its economy to investments from abroad in 1978–1979, two cities in the vicinity of Hong Kong and Macao became the initial focus of the central government's attention. Partly because of their deep-water ports, Zhuhai, adjacent to Macao, and Shenzhen, adjacent to Hong Kong, were selected as special economic zones. These two towns were expected to attract investments. A second strategy was to connect to the widespread network of Cantonese natives and their offspring in a worldwide diaspora. The Cantonese had migrated to places all over the world: to the Americas, but also to Malaysia and Singapore, where industrial development started earlier than in China. The strategies worked, and investments started to flow towards China. The two cities transformed from small towns to prefecture-level cities. Soon after, the government extended the investment zone to expand beyond the initial cities of Shenzhen and Zhuhai to all of Guangdong Province. That resulted in a conurbation of mega cities in Guangdong Province. They include Guangzhou, Shenzhen, Zhuhai, Foshan, Dongguan, Zhongshan, Jiangmen, Huizhou and Zhaoqing, as well as the two special administrative regions Hong Kong and Macau. These eleven cities surround the Pearl River Delta, with a total urbanised area of 56,000 square kilometres and a population of 72 million residents, or well over 300 million if migrant workers are counted. The Greater Bay Area, as it is now called, is the largest and most populous region in China. Its geography is frequently compared to the Tristate New York Metropolitan Area, the Greater Tokyo Area or the San Francisco Bay Area.

Since the opening of China to foreign investments forty years ago, an entire generation grew up amidst unrelenting change. The use of the word unrelenting was repeatedly voiced by professionals tasked with managing change in the Pearl River Region. For planning and design professionals, the management of change at the scale of a region remains a major challenge. The profession is better equipped to evaluate change in retrospect, rather than at the time when current development decisions are made. Change in the environment follows three dimensions: the magnitude of change, pace of change and the nature of change. Assessing the first two dimensions provides no problem to professionals aided by quantitative data on population growth, constructed floor space, roads, bridges, rail lines and GDP in general. By such measures, the magnitude of change in the Pearl River Delta has been large, even unprecedented. Initially, by the same measures, the pace of change has been great, in recent years somewhat slower, but still impressively rapid. More difficult to assess has been the nature of change. Thinking about the nature of change invites qualitative assessments that differ within social groups and the values individuals hold depending on the stage of their life cycle, their place of origin, their economic situation and their level of education.

In the Pearl River Delta, these dimensions of change take on a higher level of complexity when we consider the natural processes that act on the region. Landform, with its vegetation, water and climate have been far from static. Throughout history, the confluence of the three Pearl Rivers, with their high silt content, has added to and subtracted from the landform of the delta. Likewise, the water discharge differs

significantly between the three rivers. This resulted in shifting water flows throughout the extensive network of interconnected waterways between the rivers. The amount of rainfall during the monsoon season dictated agricultural surplus and shortfalls. With more land covered by factory buildings and more roadways and space for cars, run-off after rain events is no longer absorbed into the ground but needs to be stored until it can be channelled into the river's branches at low tide.

The cities of the Pearl River Delta owe their existence and prosperity to the tides that made the river system navigable for larger vessels. Mariners since medieval times have taken advantage of the incoming tide to reach the Pearl River Delta's largest city, Guangzhou, located 120 kms inland from the South China Sea. They used the outgoing tide for the journey out to sea. High tide in the Pearl River Delta remains something to be reckoned with, especially when the tide amplitude measures higher than normal during the lunar cycle and coincides with a major monsoon event. Such combined events were well recorded throughout the Ming and Qing dynasties. Storms produced major floods in history and more frequently now as sea level continue to rise from melting polar ice and the thermal expansion of water molecules as a result of warming ocean temperatures.

The extent of these natural phenomena is well understood. There is also growing research about social change in the Pearl River Delta Region. But, both fields of knowledge only made slow progress in forming policy aimed to guide planning and design for a sustainable future of the region. This chapter presents design proposals at six locations in the Pearl River Delta Region that were completed over a period of years from 2007 and compares them with conditions in 2021.

The most striking change revealed on the latest satellite images is the one by one kilometre grid of multilane highways laid onto agricultural land. New roadways became dividers of once continuous space. A square kilometre can easily contain a historic village, but only if the grid cells are centred on villages. That is not how the grid was laid out. Roadway design shows a bias for regularity and straightness; the grid only curves when aiming at important obstacles. Rarely do roadways curve around villages. Apparently, roadway engineers assumed that villages would no longer exist in the future.

This observation is certainly true for the first site we worked on in 2007–2008, Dadun village in the dyke and pond landscape south of Foshan. The village is easily recognisable from space. Slated for demolition at the time of our work, Dadun is still there, though truncated by two major roadways. To take credit for the continued existence of Dadun might be premature. Credit should go to the members of the village collective and their high level of organisation.

7.2 Dadun: A Village in the Dyke and Pond Landscape

Dadun, together with a string of six villages, was settled on somewhat higher ground to the north of the historic Yandu River, today better known as one of the historic Lecong waterways. To encourage rural settlements and rice production, the Song

and the later Yuan dynasty started levee construction to control the braided network of free-flowing rivers in the delta in the late thirteenth century. Foshan, a historic city to the north of Dadun, close to Guangzhou, also originated on elevated land. It grew into a large industrial city famous for its ceramics and later for ironware production. With the opening of Guangdong Province to economic development, Foshan became a prefecture city in 1983 and expanded into agricultural land owned by village collectives in the Shunde municipality. In 2003, a design competition was awarded to a US planning firm; it proposed the removal of Dadun and three neighbouring villages (Fig. 7.1). Foshan's new ceremonial axis of cultural and sports facilities aimed directly at Dadun. Foshan made partial use of the competition results. With much confidence, highway engineers laid a one by one kilometre grid of major multilane roadways over the agricultural land with a new bridge on axis across the Dong Ping River. The roadway continued on the other side of the river, directly towards Dadun. Dadun's village collective resisted and construction of the roadway stopped (Figs. 7.2 and 7.3).

7.2.1 Managing Flood Risks and Water Quality

Our team started by talking to the chairman of the village board, Liang Jinghua. As part of a village history, Liang recorded floods that had inundated Dadun from 1915 to 1988 (Liang 1988). For example, water stood 2.5 m high in 1915, in 1924 knee deep, in 1962 a levee failed and water stood 2.3 m above the land. Villagers took refuge on the second and third floor of buildings, an experience that has motivated the construction of multi-storey buildings in delta villages since.

Earlier flood records existed for a one-hundred-year period from 1736–1839, when 44 major floods were recorded: one every 2.4 years. This sequence of floods triggered improvements to flood control measures during the Qing dynasty (1644–1912): higher levees were constructed with weir-gates to divert high water into canals. But with rapid urbanisation floods continued. Most recently, so called one-hundred-year floods occurred in 1994, 1998, 2005 (Zhang 2008) and onwards in 2010 and 2018.

Recognising that agricultural work at Dadun had shifted towards factory work, our team recommended a water landscape of lakes made from obsolete fishponds and restored canals designed to retain riverine as well as monsoon caused floodwater until it can be discharged at low tide.

In addition to flood risks, villages like Dadun suffered from water contamination. Generally, delta villages did not have sanitary sewer systems. Historically, the farming population in this silk producing region gathered night soil and deposited it to fertilise mulberry trees. Villagers had planted trees on the berms between ponds. The practice was gradually discontinued when the silk industry vanished and when the ponds were used for aquaculture. Also, chemical fertilisers became available in the 1970s. No longer used as fertiliser, household sewer drained directly into the village canals. But, such drainage would only work to disperse the contaminated

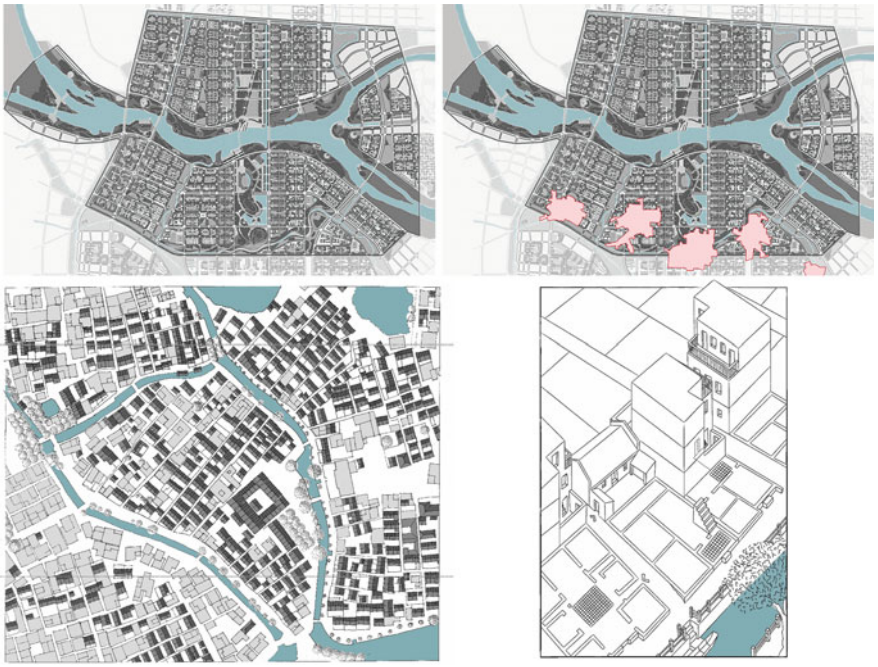

Fig. 7.1 In 2003, the City of Foshan proposed an extension of its Central Business District across the Dong Ping River, a branch of the Northern Pearl River. A plan developed by Sasaki Associates, Boston, was selected as the result of a competition shown on the left (*Source* City of Foshan, with permission from the Planning Department). The image on the right shows the proposed plan with five existing villages in that location. The villages were slated for demolition. Dadun is located in the centre (*Source* Bosselmann et al. 2010). Below left, building inventory of Dadun's central portion. Roofs rendered in dark refer to historic village structures; roofs rendered in grey refer to buildings modernised by villagers prior to 2008. Below right, detail showing new and old construction (*Source* Bosselmann 2018)

waters if the network of canals is well maintained and connected to the tidal flow of the Dong Ping River to the north of Dadun. The canals were neglected because the city of Foshan operated under the assumption that the villagers would sell their land and village. Foshan authorities installed locks that interrupted the tidal flow in the canals.

Our team took water samples inside wells, canals, fishponds and on the banks of the Dong Ping River. Analysis of our samples at a laboratory of Sun Yat-sen University showed the worst water quality in the canal in front of the Liang ancestral hall, which also coincided with the canal in front of the former primary school: the laboratory measured 200,000 mg of faecal chloroform per litre, followed by 140,000 mg inside a courtyard well of a farmstead. An amount of contamination that prohibits skin contact. A still functioning canal connected to the river measured 20,000 mg, and the Dong Ping River itself had a low contamination of 10,000 mg. The water quality in the fishpond also measured 10,000 mg. These results were critical to the discussion

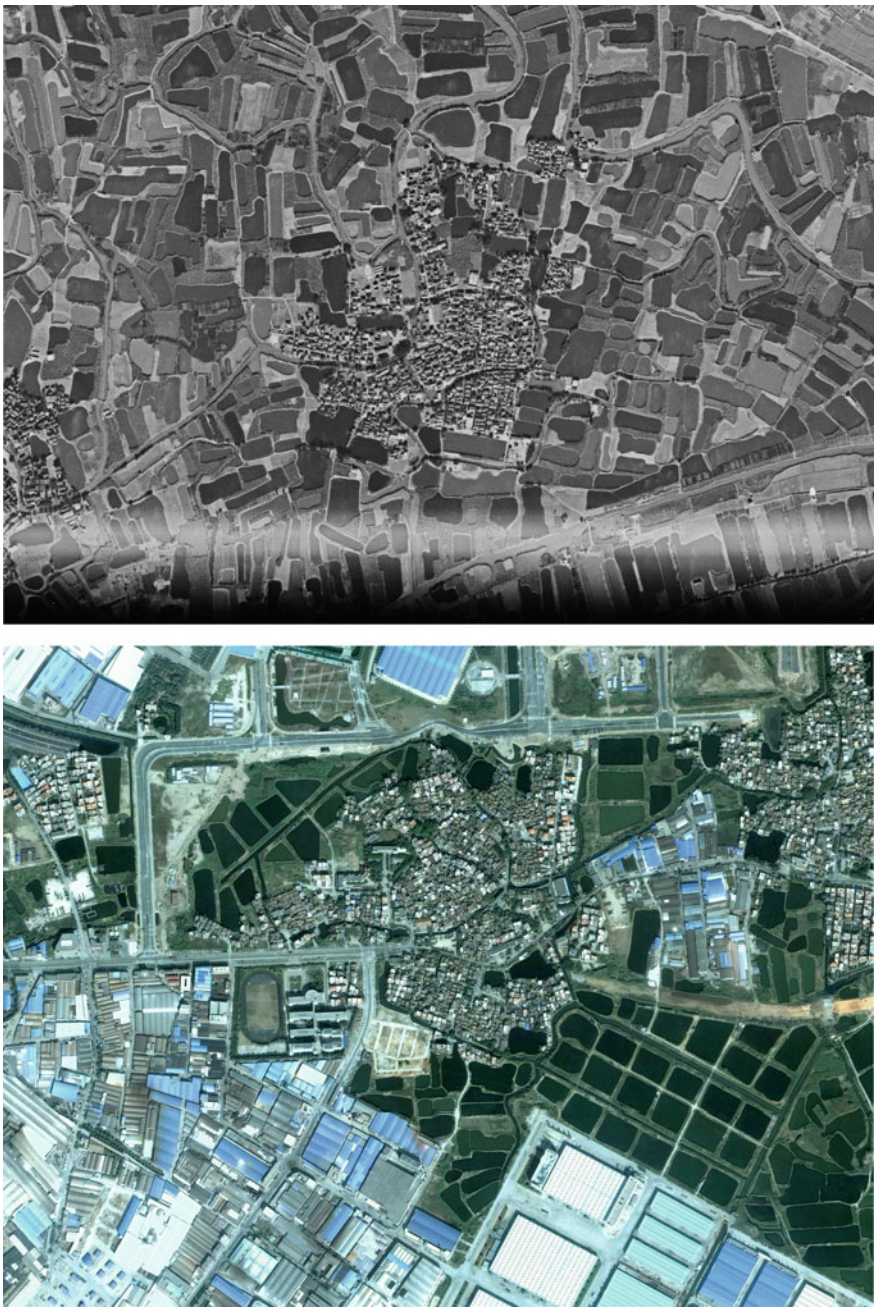

Fig. 7.2 Dadun in 1979 and in 2007–2008, at the time of our workshop (*Source* Google Earth 2006, adapted by the authors)

Fig. 7.3 Dadun in 2020. The tower block to the north-west of Dadun accommodated housing for displaced villagers (*Source* Gaodemap 2020, adapted by the authors)

with Foshan authorities that followed. Foshan opened the water lock at the entrance to the village. The village committed to laying sewer lines along the margins of the canal, and Foshan committed to connecting the pipes to a new sewer treatment plant.

7.2.2 Authority and Social Values

With the economic opening of the region, the northern part of Shunde municipality, where Dadun is located, attracted large-scale furniture manufacturing, and with it a workforce of migrant workers who came to the Pearl River Delta from rural parts of China. In need of housing nearby, they rented rooms in villages. Dadun became a dormitory. In fact, the migrant worker population at Dadun had risen to 6,000 renters in 2008 and outnumbered the 3,500 villagers. The villagers benefitted from the rental income and used it to make improvements to their dwellings. Given the tight land coverage inside the village, they added more space vertically rather than horizontally. Villagers also built new homes at the village outskirts in order to rent out their former homes inside the village. The village council exercised permitting authority, but officials in Foshan criticised building activities. Some of that critique might have been justified, but it was clear to the villagers that officials in Foshan

did not want Dadun to grow, rather it expected the villagers to give up, take the offered compensation and use the money to move into new high-rise towers under construction in Foshan.

Our team recommended a more deliberate approach that envisioned a more gradual transformation allowing the village collective to maintain their independence and decision-making about how their members would like to live in the future. Change was inevitable. Life would not return to an agricultural economy, but as long as the collective held together, individual members could modernise an existing home, expand or reduce space depending on family size, take in an elderly family member or rent out space. Life in the uniformly designed high-rise clusters would not offer such freedoms. A move away from the community would also alter tangible qualities like reverence at the ancestor hall and the Taoist temple, collective care for the elderly and children.

Important for our team was the consideration for the future of those who rented space at Dadun. While members of the collective have the right to compensation in the event of a sale, there is no guaranteed protection for renters. They would be subject to eviction. Initially, much economic activity in Guangdong Province had been fuelled by work for low wages, but new housing for low-income wage earners was unaffordable. Villages like Dadun provided rental housing at a cost workers could afford. A trend had started with the beginning of the new millennium that made industry hold on to an experienced work force. What was needed was industry sponsorship that made it possible for workers to transform abandoned buildings in villages like Dadun and through self-help build homes for themselves. An old idea, successfully demonstrated in many developing countries regardless of their government's political ideology (Turner 1976; Habraken 1982) (Fig. 7.4).

In the 15 years that lapsed since we started our work in Dadun, the demographics changed in Guangdong province.[1] The village population is ageing. Different from the previous two decades after the economic opening, the trends to hold on to qualified workers changed the definition of what it meant to be a migrant worker—or the more derogatory label, member of the *floating population*. Helen Sui in her research convincingly documented that workers who had migrated to the Pearl River Delta are floating less than assumed. Indeed, a second generation of migrant workers has been born locally with fewer ties to the rural origins of their parents (Sui 2007).

According to China's 2020 census, the young population of up to 14 years old has grown by 3.2% in Guangdong Province since 2010. Children of migrant workers, together with children from neighbouring villages, go to the Dong Ping primary school; nearby, at the middle school for older children, students number around 2,000 children. The increase in young people has kept the school population at a healthy level. Demographers are concerned about the population group of 15 to 59 year olds. This group shrank by 5.63% (Statistics Bureau of Foshan City 2021);

[1] Statistics Bureau of Guangdong Province, the Seventh National Population Census Leading Group Office of Guangdong Province. Bulletin of the seventh national census of Guangdong Province (No. 4)—age composition of population—15 May 2021.

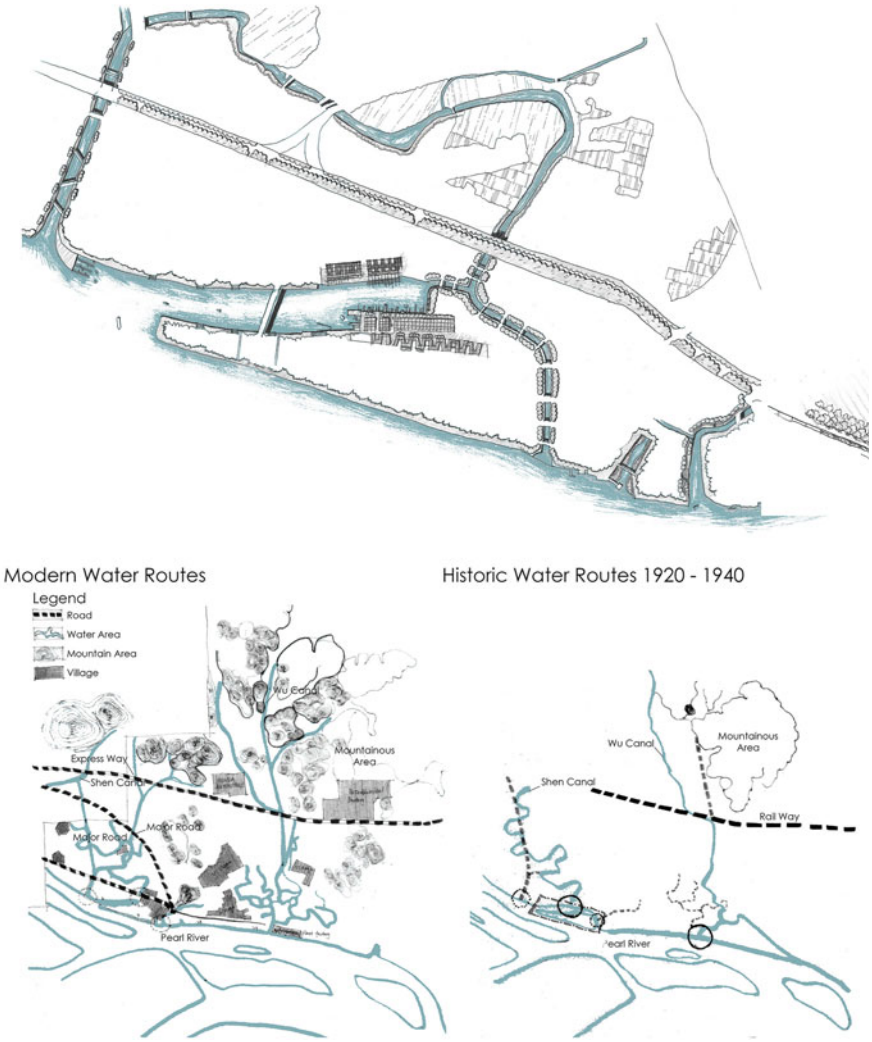

Fig. 7.4 Whampoa Harbour. Maps below illustrate the waterways at Whampoa Harbour. The harbour, itself a former arm of the Northern Pearl River, became available for new development after port activities closed. Shown on the right is the proposal of a multifunctional development that resulted from the 2009 design workshop (*Source* authors with UC Berkeley and SCUT students)

and the elderly, those over 60 years of age, increased by 2.4. Rental space in Dadun played an important role in this 10-year period of transition.

Not anticipated by our team was a 2009 political decision by the Guangdong Province government to transfer land use jurisdiction over Dadun and neighbouring communities from Foshan prefecture back to Shunde municipality, where it had

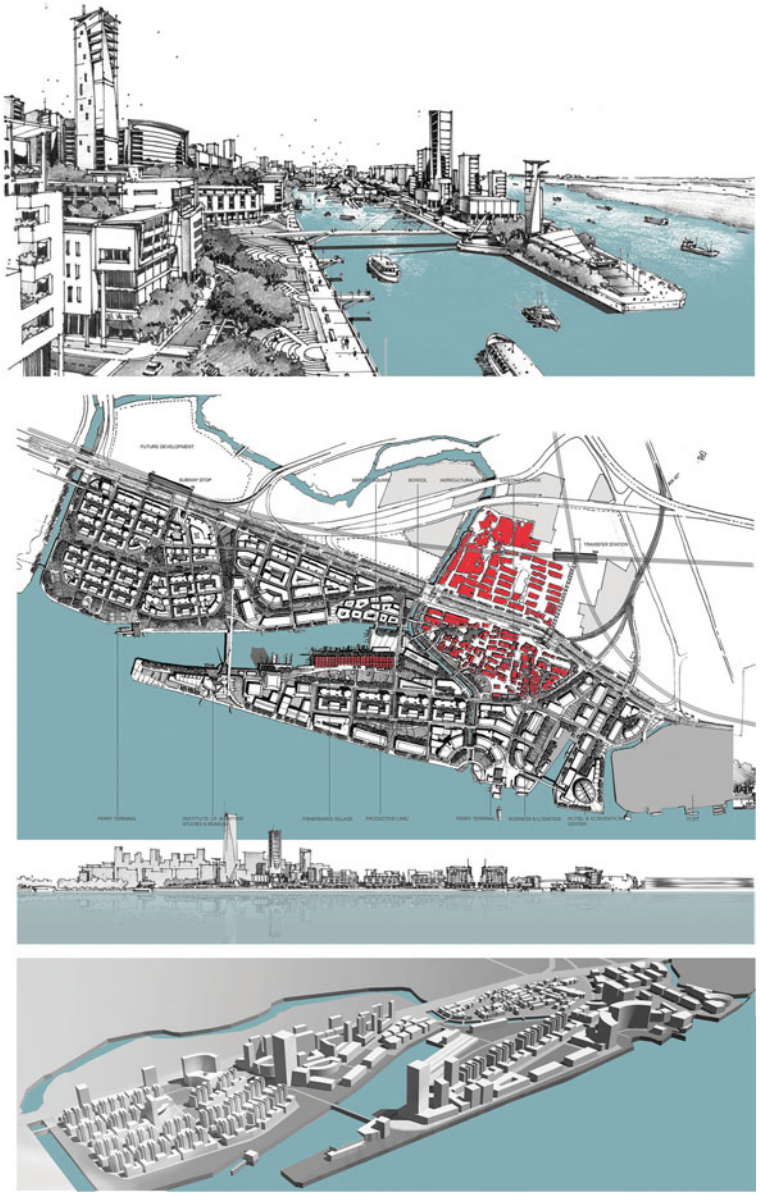

Fig. 7.4 (continued)

been administered prior to annexation. The province exercised land use authority consistent with policies of the Chinese central government.

7.3 Whampoa Harbour 2010

Whampoa is the name of an anchorage that was the terminus for foreign ships sailing up the Humen (Tigris), a tidal estuary into which both the northern and eastern branches of the Peal River empty. Modern port activities there largely ended once a new container terminal came into existence closer to the South China Sea, but at the time of our work in 2010 (Bosselmann 2013), non-containerized shipments, like steel and a large cross section of exotic lumber, still arrived at a Whampoa basin. The basin was also shared by 'boatpeople', who lived partly in a floating village and partly on land. Boatpeople are members of an ethnic minority believed to be descendants of the delta's indigenous population prior to Han Chinese migrating into Southern China.[2] Boatpeople form tightly knit communities in various waterway locations of the Pearl River Delta (Hürliman 1962).

At Whampoa, we focused again on two issues: land use and fluvial history. Formerly, small waterways connected the harbour to inland locations. Their role as a transportation system used by sampans was abandoned long ago, and the canals have been filled with debris, and some still function as open sanitary sewer lines. In the future, with more urbanisation and more hard surfaces, the canals can take on a new role as drainage channels and increase water storage during tidal floods and monsoon events. For six months a year, from April to August, precipitation averaging 30 cm a month contributes to the annual 1.7 m of rainfall. Given the high ground water table and water-saturated low-laying terrain, run-off needs to be stored until it can be discharged at low tide.

By the time, we started work on the Whampoa Harbour area; changes in land use were discussed at the Whampoa municipal level. Our team argued for multiple future uses for the 60-hectare site and illustrated possible building scenarios (Fig. 7.5). In the first decade of the twenty-first century, strong land use controls were enacted in Guangdong Province. Changing land use became a difficult undertaking. Local governments had to go through a long process with different committees. Decision-making about development became subject to greater scrutiny, which was an improvement, but changing land use from industrial to other uses like housing remained almost impossible. For that reason, the Whampoa municipal government did not propose a change in land use, but simply a transfer of the site from receiving steel and precious wood to a trading floor where such commodities were auctioned. Feng Jiang observed that as a reaction to tight land use control planners assumed that

[2] Sui Seung Yan, 'those born on the water'. Boatpeople are also known by the derogatory term Tanka. The Tanka are considered by some scholars to be related to other minority peoples of southern China. The anthropologist Ling Huihsiang argues that the Tankas are descendants of the Bai Yue.

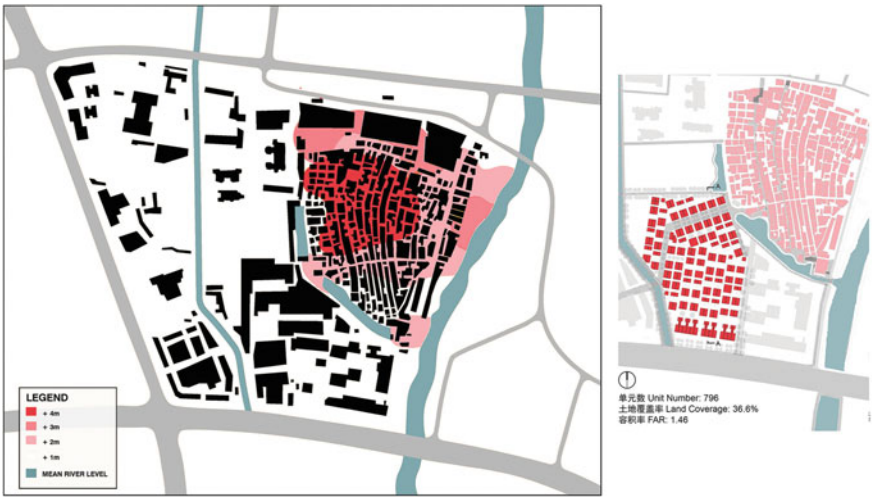

Fig. 7.5 Historic Xinxi village (New Stream) is located on a hill as shown below in grey tones adjacent to a channelised tributary of the Northern Pearl River. Shown on the right is an extension of Xinxi proposed to replace warehousing owned by the village collective (*Source* Bosselmann et al. with UC Berkeley and SCUT students 2012)

a parcel of land should be used for a single function (Feng 2015). But given the high cost of infrastructure investments and the goal of reducing private vehicular transport, mixed-use development would be more sustainable and is generally preferred. The Guangzhou Urban Planning Design and Survey Research Institute agreed. They developed a control and master plan. In 2013, Skidmore Owings and Merrill's City Design Practice in San Francisco was commissioned by a private developer to develop a refinement to the concept plan that met our objectives.

7.4 Xinxi 2013

Xinxi means *new stream*; the name referred to a small water course that exists today in the form of two constructed lakes to the west of a village with the same name. The water in the former creek bed is mostly stagnant, but hydrologically connected to the Wuchong Canal that borders the village on the east. As a tributary to the Northern River, the Wuchong Canal at Xinxi is subject to tidal flows. The village was established on a slightly raised hill at the confluence between the two waterways. Historically, both creeks functioned as free-flowing waterways and occasionally flooded the area near their confluence. Water flow in both creeks was regulated: Wuchong Canal runs between embankments, and Xinxi Creek was channelled into a small culvert further to the west of its historic course. On the south-facing slope of the hill in the direction of the historic confluence, the village formed as a comb-shaped layout with

rows of village homes along narrow lanes that sloped uphill. A street across the eight lanes functioned as the main street. It was the location of an ancestor hall that was no longer in use when we did our design and planning work in January of 2013.

One part of our team worked on a design that restored the flow of water in the former Xinxi Canal by tapping into the culverted section of the diverted creek to improve the quality of the currently stagnate water. The restauration would also improve the air flow up the narrow lanes and restore the village's orientation to water at its southern end. It was also important to improve the living conditions for the village occupants without displacing them, be they owners or tenants.

At that time, we wrote: 'a village where the villagers are inclined to hold on to their collective ownership, at least for the time being' (Bosselmann et al. 2014). A 2019 satellite image shows the village without any noticeable change, but that is misleading. Apparently, the village committee agreed to a sale that was initiated at a December 2019 meeting (Fig. 7.5). The decision comes not as a surprise because already in 2013, the villagers in the neighbouring village had given up their ownership and demolition had begun. In contrast, the Xinxi villagers showed no interest in selling their village and land because they had diversified their economic base. They had sold a portion of their farmland to a political party for a training facility. From the funds gained, they had built a hotel. They had kept a piece of low-laying land for a vegetable farm to grow produce for a large restaurant with seating under a large roof structure. And they had converted the rest of their farmland into a warehouse complex that served the nearby port. The Xinxi collective had benefitted from an income stream, apparently sufficient to ward off any voluntary takeover by government or by developers. In addition, the 800 members of the collective benefitted from renting out rooms inside the village to a population of approximately 2,400 migrant workers. This elaborate arrangement of collective ownership of land and property came to an end in 2019. At the time of this writing, we learned that the village is now under a developer sponsored urban renewal process that will erase the village.

Anticipating, but not knowing the outcome of future decisions by the villagers at the time of our work, we conducted an experiment exploring the conditions that would need to be met in order to provide affordable housing for a population of workers and residents left out of the housing market. Guangzhou makes affordable housing available to low-income residents at a cost of a monthly rent of 29 yuan per square metre, but in 2013, migrant workers were not eligible for government sponsored housing.

We used the collective's 3.8-hectare warehouse complex as a potential site to build at least 600 units of affordable housing that would incrementally allow renters to move to upgraded living conditions. The difficulty with such a proposal was that the village collective cannot use any of its assets as collateral because banks cannot repossess assets of a collective in case of loan default. Only a developer could take out a mortgage, but that would necessitate a sale. At the time, the villagers would not agree to such a sale, and a sale involving a developer would make the cost of housing unaffordable for the group we had targeted. Our calculations showed that 4.4 million yuan would be needed for construction, plus carrying cost over 15 years

at 6.5% interest, which would bring the loan to 114 million yuan. That would result in a 1,500 yuan monthly rent for a 75-square metre unit or 20 yuan per square metre.

Our solution at the time was to propose sponsorship of housing by the industry that has an interest in retaining qualified workers. Eventually, such a model would become necessary if the government continues to restrict access to affordable housing for migrant workers. Industry would need to guaranty the loan for construction and financing. Two workers who bring home 1,550 yuan each per month, the minimum wage in Guangzhou at the time, would have difficulties paying the 1,500 yuan rent for a 75-square metre unit, unless they take on a third tenant. But, two established workers making 2,400 yuan per month each could afford such a flat (Bosselmann et al. 2014). The cost for rent calculated here compared more favourably to housing financed by the government and made available to low-income Guangzhou citizens.

During our work, we became aware of the discussion about the future of workers with rural registry from outside of Guangdong Province. The Xinxi villagers had provided a place of transition in which migrants gradually become citizens of the city (He et al. 2010). The emphasis is on gradual. In the last 10 years, the population of Guangzhou increased by 5,975,805 citizens, many of them with former rural registry. In urban villages like Xinxi, groups of migrants from the same rural region settled where peers already lived, forming sub-enclaves where language, food and traditions can be easily shared.

The urban renewal process that now unfolds largely ignores the fate of the migrant population. It will proceed by developing the village land in eleven phases. The development company will start with parcels closest to the metro station in the northern portion of the site and build a commercial high-rise tower followed by demolishing mid-rise structures from the 1980s and replacing them with seven residential towers. Demolishing Xinxi village will take place in four later phases with one labelled as the 'start-up resettlement', which coincides with utilising the warehouse complex that we used to demonstrate how affordable housing could be realised. The nine towers that eventually replace the village will have a range of apartments differing in size from 46 to 125 square metres with a monthly rent of 44 to 50 yuan per square metre (CPC Huangpu District Committee 2021).

7.5 Jiangmen

After the opening of China to foreign investment, Jiangmen became a prefecture-level city in 1983. Tangjiang River is draining directly into the South China Sea to the west of the Pearl River System. The waterway at Jiangmen connects the two river systems. In 1902, forty years after European powers concluded the Second Opium War against China, Jiangmen became a treaty port. Foreign shipping companies reclaimed land along the river embankment of the historic centre and built three-storey shop-houses in tight rows on narrow lots that formed fifteen urban blocks. The design of these blocks was carried out in an eclectic colonial style with arcades across all properties fronting the streets. In the 1980s, the town centre was slated for

demolition to make room for a contemporary commercial and administrate district; the central government intervened and a new city centre was built further inland.

By 2012, when we worked on the historic centre of Jiangmen, the city was committed to 'the preservation and upgrading of streets, urban blocks and buildings with the goal of improving the quality of life for all its current residents' (Bosselmann and Moos 2014). The reality in modern-day China is that residents who own cars have moved away from the centres to modern developments at a city's outskirts. Elderly residents remain. Migrant workers and low-income residents move into flats that owners make available for rent, owners, who in many cases had left China during the twentieth century or earlier. Observations about income, car ownership and mobility raise important questions about who will benefit from the renewal of a historic district. For current residents to benefit, improvements must remain affordable for workers who earn low wages in an economy where the cost for housing and transportation has risen disproportionately to wages. This would require incremental renewal to avoid displacement of current residents. It would require low-interest loans to upgrade properties in the form of code enforcement grants (Fig. 7.6).

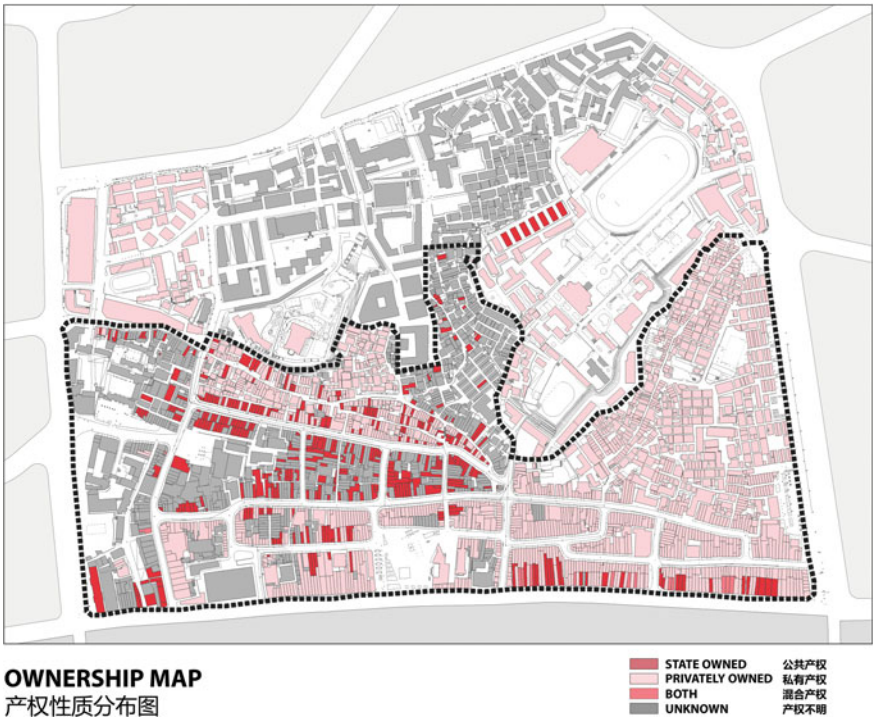

Fig. 7.6 Jiangmen is located on a tributary of the Western Pearl River. Below, property ownership in Jiangmen's historic centre (*Source* City of Jiangmen, with permission from the Planning Department). Right: an inventory of urban blocks and proposed block repair (Bosselmann with UC Berkeley and SCUT students 2010)

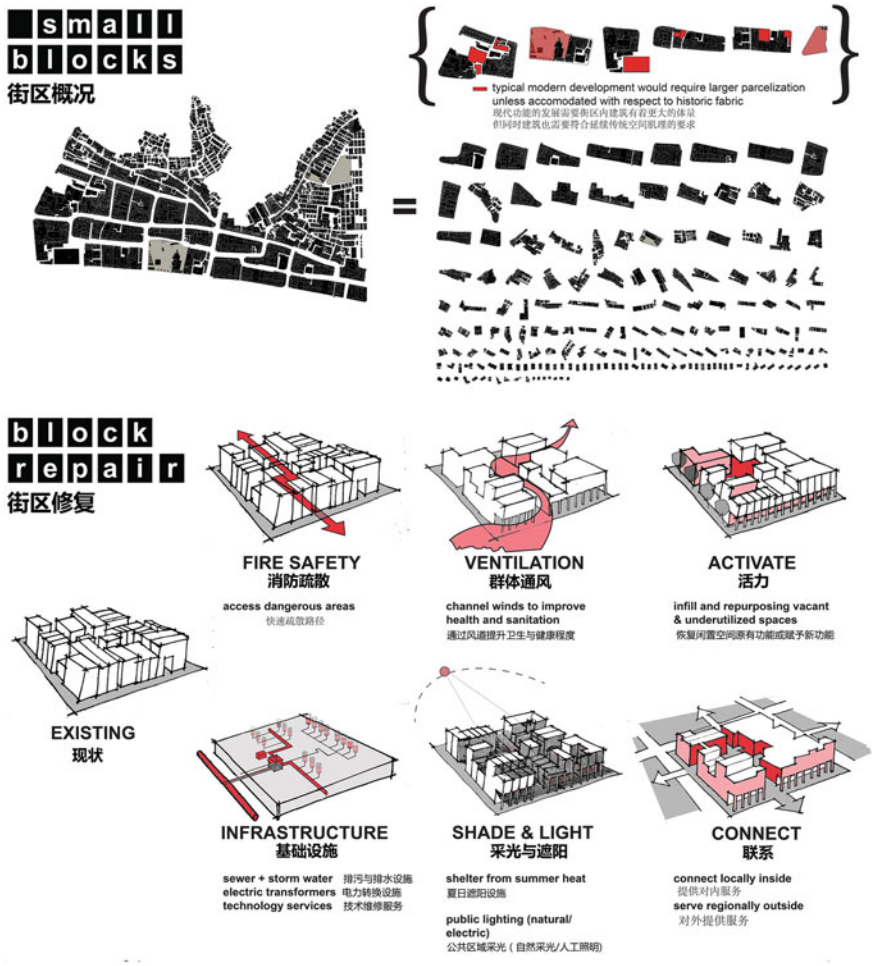

Fig. 7.6 (continued)

The young design professionals in our team working on Jiangmen in 2012 enjoyed the active street live, the mingling of several generations and the comfortable climate of shaded streets benefitting from natural ventilation even on hot days (Bosselmann 2018, pp. 123–132). The covered market street, the promenade along the river lined with mature banyan trees and the shops and restaurants at ground level all contributed to an ambience rarely observed in the new urban development districts. These young professionals could see themselves living in such a setting. They designed infill structures in the tradition of the narrow row houses, but with modern sanitation and two ways of egress to address fire hazards (Fig. 7.7). Eventually, such infill structures will be built, but in the ten years that have passed since our work, none of that has happened. This is not surprising, and if such infill will be built, for reasons of social

equity, infill should preferably happen gradually. The cost associated with such infill will necessitate residents of higher income, who, as residents with higher income, would not move to the centre out of economic necessity, but to live in a relatively car-free environment, where they are able to walk to places for their daily needs and enjoy social diversity.

Research on attachment to place and the different reasons for attachment has its roots in the Gestalt theories of the 1940s. Environmental psychologists have recognised its importance since Kurt Lewin coined the term 'field theory' (Stokols 1987). More recently, Renee Chow built on field theory in her book, *Changing Chinese Cities* (Chow 2015). Historic preservation of urban districts is still a relatively recent trend in Chinese cities. In the long run, investments made in such districts will create values associated with the public good that outrank investments in the new developments on the city's periphery.

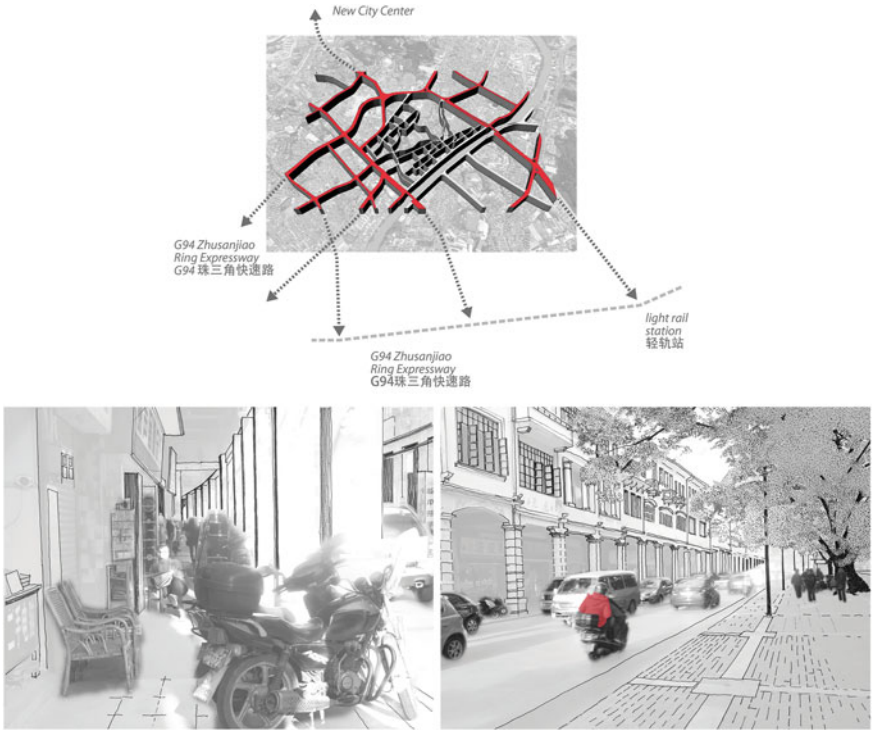

Fig. 7.7 Repair of Jiangmen's shop house typology (*Source* Bosselmann with UC Berkeley and SCUT students 2010)

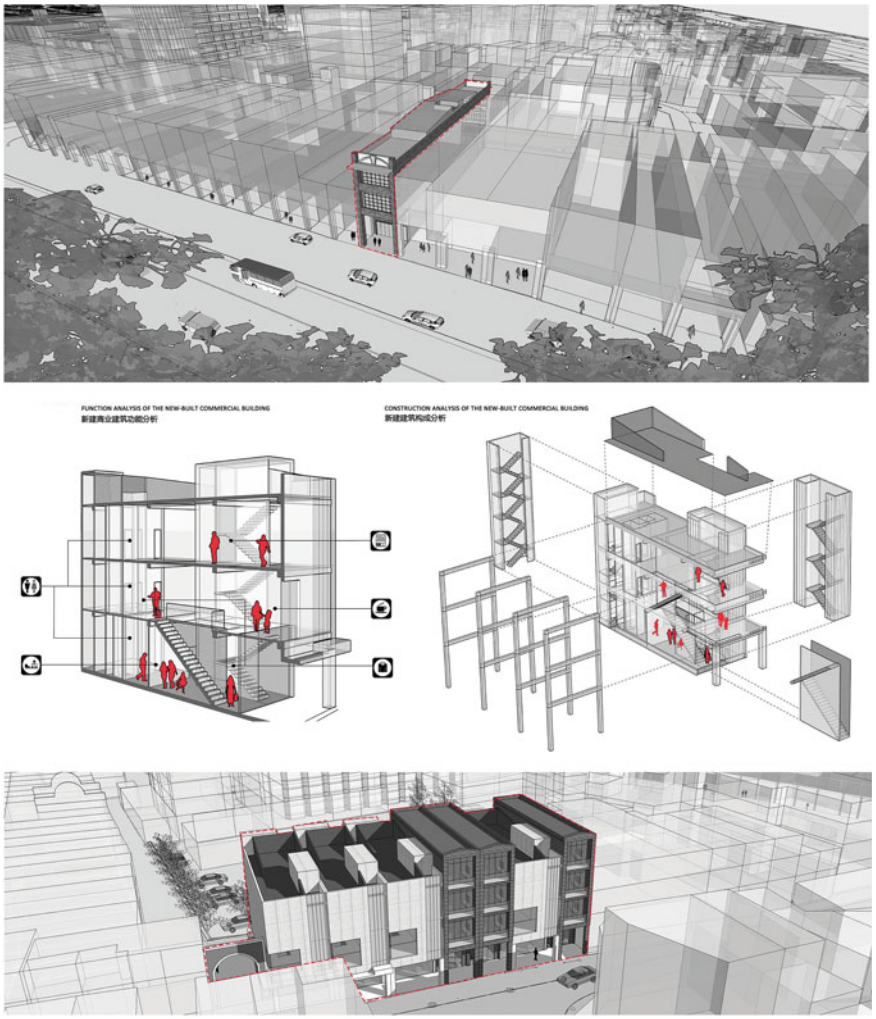

Fig. 7.7 (continued)

7.6 Pazhou Island East

Pazhou Island is located in the flood zone of the Bei River, the northern branch of the Pearl River. As the river runs from west to east along the south-facing slope of the Baiyun Mountains, the floodplain lies low, barely above the water table of the river at high tide. The floor of the riverbed at Pazhou Island is three metres above mean sea level; the river has a depth of 6.3 m at that location. The ground elevation on the island measures 7.5 m above mean sea level, the island's protective levee measures at 8.05 m above mean sea level; the tidal aptitude between low and high-tide amounts to

approximately one metre—higher during the twice monthly atmospheric tide, even higher when the tide is driven by strong winds.

On our first visit in the fall of 2014, all former agricultural use of the island had ceased on the western part of Pazhou Island. Only an experimental farm remained; it belonged to the Vegetable Science Institute of Guangdong University and was still operating on the low-lying terrain. The farm served as a reminder of how vegetables were grown on land that was subject to occasional flooding. There were 30-cm-deep channels between rows of vegetables designed in a grid to drain the land after rainfall. The villagers on this part of the island had given up their fields; and their village had been demolished. Villagers now occupied 670 units in thirteen 30-storey high-rise slabs. A hospital was under construction, as was a high-rise tower for a media company.

Pazhou Island was slated for a media technology centre. Closer to the middle of the island, a new bridge across the Bei River had been completed for the privately financed South China Expressway. It was designed to serve the huge hangar-like structure of the Pazhou Convention and Exhibition Centre, host to the biannual Canton Import and Export Fair. In the design workshop of January 2015, we focused on a 200-hectare site facing the Bei River between the western end of the island and the convention centre. The impervious surfaces in its predevelopment condition totalled 46 hectares, an area that will increase to 98 hectares once completely developed. The monsoon on 10 September 2010 dropped 202.5 mm of rain, resulting in run-off from the undeveloped of about 93,100 cubic metres. With new development and reduced infiltration, the same storm event would result in 180,000 cubic metres. Even though the island was still largely undeveloped, after the storm in September 2010, run-off flooded streets and underpasses around the new expressway and only slowly drained off over the course of several days.

During the workshop of January 2015 (Bosselmann 2018, pp. 132–140), we designed an urban district of multiple uses around a proposed subway station. The district included housing for the population that would staff the media industry on the island. Our design addressed water management in a manner that became known as *sponge city*. Potential flood water from monsoon events and/or tidal flooding could be absorbed after storm events and stored under streets that drained into an existing lake, where water could be further stored prior to discharge into the river. Three additional river-bound streets drained into a reservoir along the river embankment, again for later gradual discharge into the river at low tide.

Official planning for the western part of Pazhou Island had proceeded too far for our recommendations to be adapted. The land area of the site was filled with construction debris to eight metres above mean sea level. The lake we had envisioned to use for water storage was also filled. Urban blocks of 160 by 160 m were laid onto the land. Each block was designated for single commercial use and developed as such. Our proposal consisted of a future mixed-use development with small urban blocks designed to encourage living in walking distance to workplaces. Our urban blocks measured 75 m along the east–west streets and varied on the streets leading towards the river.

It is important to note that the Pearl River Delta is subject to long-term geological subsidence (Wang 2012). Reclamation fill made of construction debris places additional weight on the soft subsoil and results in additional differential settlement. The combined subsidence affects roadways, water and sewer pipes below streets and necessitates periodically raising levees along the river.

In January 2019, we returned to Pazhou Island to work on the eastern part. Development of Pazhou's underused eastern 400 hectares was seen as a missing piece in completing a new centre in the design of Guangzhou's polycentric Greater Bay Area. One of the observations our team made was about then steadily increasing expectation of Pazhou Island's development potential. These growing expectations were fuelled both by the provincial government and by the developer community (Fig. 7.8).

We recognised that greater caution was necessary when setting goals for the amount of development that government should authorise for the central and eastern portion of the island. Our concern resonated well amongst the government officials, especially at the regional level, but also at the level of Guangdong Province. Understandably, concerns about the greater frequency of disastrous floods were on everybody's mind. In 2018, the year prior to our workshop, typhoon Mangkhut had occurred on 15 September when the high tide reached 8.23 m above mean sea level

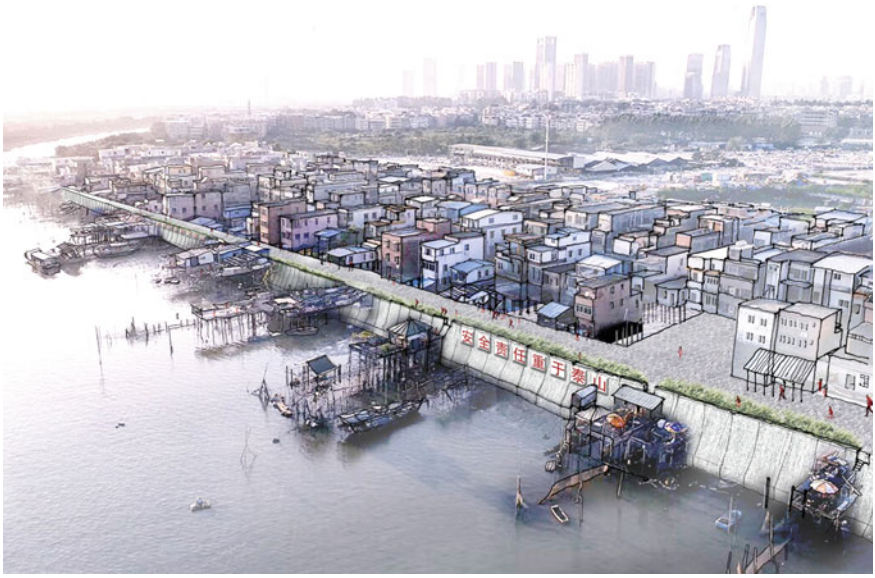

Fig. 7.8 Eastern portion of Pazhou Island. An existing fishing village is shown in the foreground, historic Pazhou village in the middle and newly constructed high-rise development on West Pazhou Island in the background. A new seawall is graphically superimposed and designed to protect the southern shore of Pazhou Island, which is currently unprotected during storm events. The jetties in the foreground have a partly religious as well as functional role (Drone picture by Aaron Xie; drawing by Bosselmann and Li 2019)

at the Sun Yat-sen University tide-gauge station, which was a water level higher than the 8.05-m elevation of Pazhou Island's flood control dyke (Fig. 7.9).

High expectations about a buildout of the island would make disaster prevention costly, if not impossible. Instead, we recommended a process of incrementally permitting development in locations well served by transit, but not on low-lying land adjacent to the seven still existing villages.

Our second recommendation at the time urged the government to preserve all existing 80 hectares of low-lying land and to design this land to be suitable for flood water storage (Fig. 7.9). Recent history showed that combined storm and high-tide events had devastating effects on the island even with its then semi-industrial and rural land use. In the future, many new roads and building would further reduce infiltration and increase storage needs for floodwater. We quantified and documented future floodwater storage needs for two development scenarios of different intensity (Bosselmann et al. 2019). We also computed how the perimeter of the island should be strengthened (Fig. 7.10).

Clearly, floodwater storage capacity below streets and parking areas would become necessary under even modest development scenarios. With high development scenarios, water would need to be channelled away after storms to storage areas on low-lying land. Our computations showed that an exclusive reliance on storage capacity below streets and parking areas would not suffice during major storms.

7.7 Conclusion

Our work was done in an educational setting where young professionals were encouraged to develop ideas that value the environment and the people who live there. We started by asking what long-term policies should guide our designs. The challenge then was to demonstrate the implications of such policies through design or alternative designs. Naturally, our ideas frequently clashed with standard planning practice, like the way street grids are currently designed, largely as barriers with a bias only for vehicular mobility. The list goes on, like the bias for single-use developments, whereas multiple use offers many advantages. The size of urban blocks is generally too large and not conducive to walking. Then, there are deeper rooted convictions like the assumption that conditions will return to an equilibrium after interventions caused by humans or nature. An equilibrium is rarely ever found in cities or landscapes; constant change will continue to prevail into the future. The lessons for architects and professionals in the related fields were to learn not only to fulfil the needs of the present. Present conditions never last for very long. They certainly do not last long in an environment dominated by water like the Pearl River Delta—an important lesson for us all.

Fig. 7.9 Six existing villages on East Pazhou Island. We proposed to preserve a total of 80 hectares of low-lying land adjacent to the villages and design the land to store floodwater after monsoon and combined tidal surges during storm events (Bosselmann et al. 2019)

Fig. 7.10 A high development scenario for East Pazou Island (top), and a moderately high development scenario concentrated at three subway stations (below). Existing low-lying land amounting to 80 hectares would remain undeveloped and would be designed to store floodwater after monsoon and tidal surges (Bosselmann et al. 2019)

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