

Critical Integration – Zoning for Regional Sustainability under Rapid

Urbanization Process of China

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1. Background

China's present development is rapid and still accelerating. Negative effects of early development have drawn attention from all professions to discuss for an appropriate solution. Proposals like carbon cycle and eco-cities have been raised. Yet, the solution is still at large. The high complexity of the subject and the consequence requires multi-discipline discussion and careful study of the issue. In this paper, we are not going to be over-ambitious to provide a definite solution. Instead, we shall discuss the current major concerns of development in China for the reader's further debate for an appropriate methodology.

Urban growth has been a major phenomenon resulted from development. For the 1.3 billions population of China in 2006, about 43% (560 thousand) is living in urban areas. The urban population is expected to increase further in the near future. Within the past 10 years, urban population has expanded for roughly 10%. Considering the current economic growth, accounting the local increase of population in urban areas and rural-urban migration, the rate shall continue to increase in the coming years.

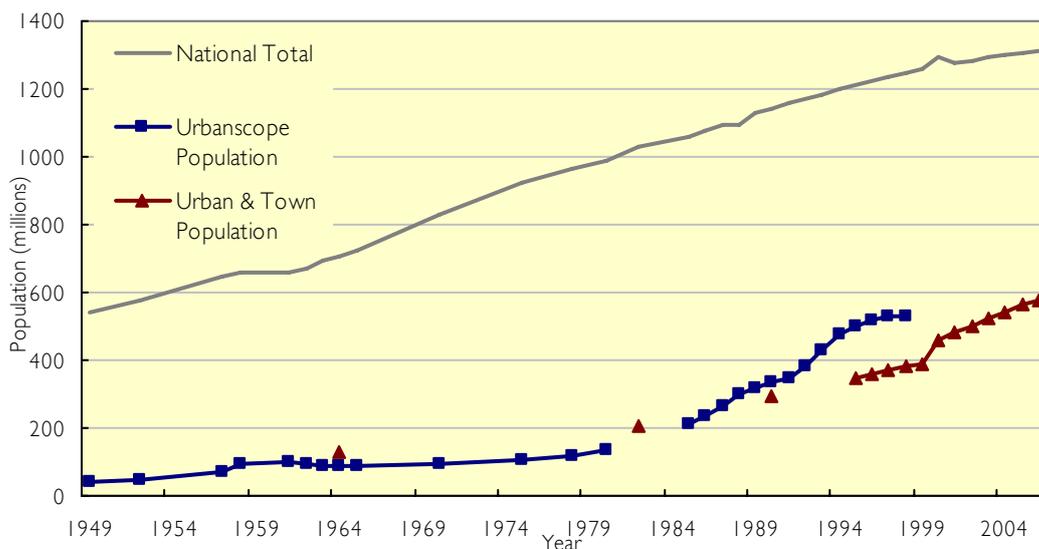


Figure 1 Urban population growth of China form 1949 to 2006 (Source: Data from National Bureau of Statistics)

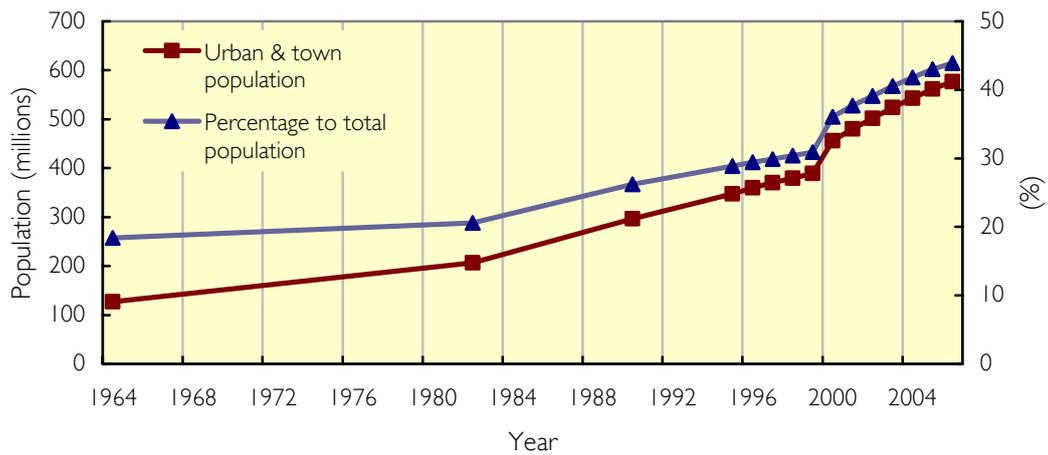


Figure 2 Urban and township population growth in China (red) and its percentage of total population in China (blue) (Source: Annual Reports of National Bureau of Statistics)

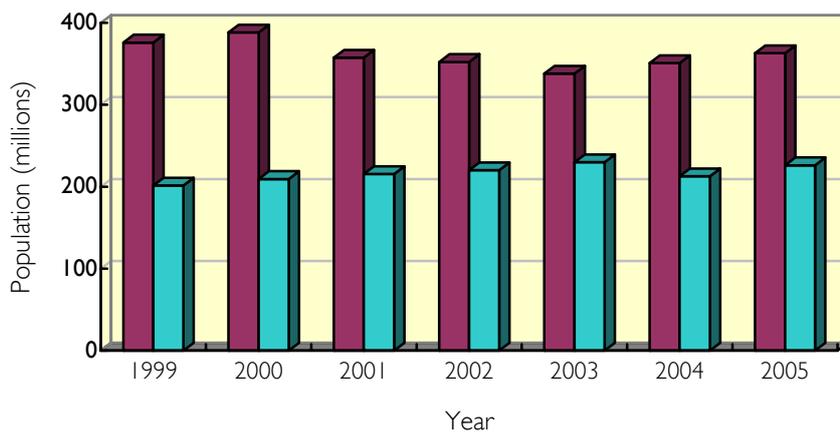


Figure 3 Urban population (purple) and non-agricultural population (blue) in China from 1999 to 2005 (Source: Statistics Yearbooks of China City Constructions and China City Yearbook)

Resulted from urban population growth, super cities in China are also experiencing a rapid growth. By year 2000, the 13 super cities in China together have shown an annual increase of built up areas by 3.5% (105,685ha). The phenomenon is especially intense in the region of the Beijing, Shanghai and Guangdong area. The urban growth of Beijing, Shanghai and Guangzhou together amounts to 61.54% of total growth of built-up area of all large cities in the past 10 years expanded over 50km² (Zhao et al, 2004)

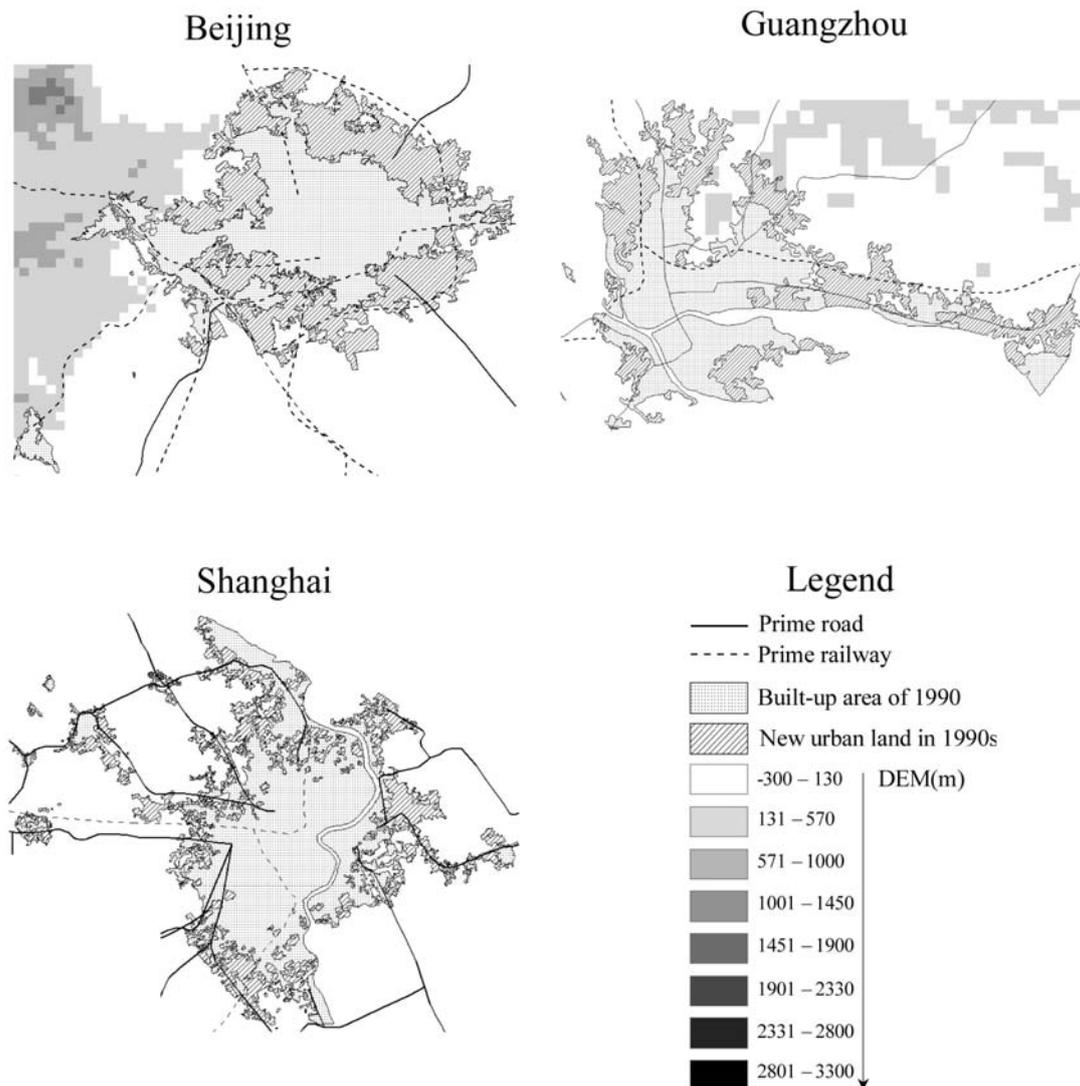


Figure 4 Urban sprawl examples of Chinese cities after 1990 (Zhao et al, 2004)

Inevitably, to sustain the current urban development shall become one of major challenge of the nation in this century.

The major issues related to the current urban population growth can be summarized into the followings:

- a. Consequence of the lack of control of city planning: density and size control
- b. Over consumption and pollution endangering the energy security and natural resources in China
- c. Conservation of national heritage is threatened by the city development

Consequence of the lack of control of city planning: density and size control

The current municipal policy lacks control and limitation of urban sprawl. Rapid, uncontrolled expansion of city size gobbles up large amount of farmland, and threatens natural resources. China's arable land shrank to 121.8 million hectares by

the end of October 2006, losing 306,800 hectares in the first ten months of 2006. A national land survey (excluding Hong Kong, Macao and Taiwan) by the Ministry of Land and Resources showed farmland used for construction totaled 258,533 hectares last year, down 24 percent from the same period the previous year.

The economic transformation causes new types of land uses. The hybrid form of industrial and commercial buildings increases the complexity of planning. The old planning policy and city management based on industrial city model cannot adapt with the current city structure. The phenomenon shall be discussed on the later part of the paper.

Super-density within cities and related problems

The destructive development of major cities is causing numerous problem related to scale and density of the cities, which can be observed in the following aspects:

Crowdedness in urban area and potential health problem

Crowdedness within cities carried potential hazard of health and hygiene. The possibility of outbreak of infectious disease increases with crowdedness. The scarlet fever in the 18th century in London and SARS in Hong Kong 2003 caused death, panic in society and economic loss. These are valuable examples which should not be repeated.

Urban decay and inner city slum

The urban decay creates push factor pushing the citizen to live in the periphery of cities, causing urban expansion. Citizen moves towards the city edge to look for a better living environment. Early planning in large cities in China of building new higher density housing encouraged such move.

Deterioration of city centre is causing formation of inner city slum within super cities. When the PRC was newly formed, there were large patches of low quality housing hastily built to provide housing and minimal administration office when the nation was recovering from wars. Those buildings were poorly maintained during Cultural Revolution, are now decaying rapidly.



Figure 5 Demolishing of old city in Beijing (Courtesy of Ms. Randian (left) and Mr. Chenhua (right))

The existence of inner city slum not only creates social, hygiene problems. It also hinders the progress of urban renewal and infrastructure implementation. Example may be drawn from Dharavi, the largest inner city slum in India, where all water supply, electricity, and public transportation stop at the edge of the slum. Complex problems of social exclusion, hygiene, safety are difficult to resolve.

Lack of efficient, optimized infrastructure and transport network within city

Lack of well planned public transportation and the insufficient of road capacity in early planned cities cause heavy traffic demand within the city. The famous heavy congestion within large cities like Beijing and Shanghai reflects the problem. Residents often take 1 to 2 hours to travel to work. This shows the problem in planning result into unnecessary time and fuel consumption for long distance travel from home to work.

At this point we may note that before economic transformation, the “work unit” (單位) culture ensures housing adjacent to work place and was efficient in reducing traveling time. However, since the change in social and economic structure encourages market economy, employer prefers to subsidize the worker on money instead of providing living apartments. On the other hand, the “work unit” suits better to economic structure based on factory industry. The breaking up of spatial relationship and marketized housing provision contributes substantial increase in housing amount and price.

The infrastructure network in many major cities has not been properly maintained. Deteriorating infrastructure network is in need of renewal. Under-development of infrastructure system cannot meet up the demand of the growing need of power and fresh water supply of expanding urban population and economy. With the current

speed of urban growth, the expansion of city size is rapid. Existing infrastructure cannot reach the outer skirt of the city. The cost of expanding such network also strains the local government resources to upgrade the existing inner city network. It is essential to limit the size of the city to the optimized scale of a sustainable infrastructure network.

Lack of strategic planning in resources endangering the environment and energy security and natural resources in China

Lack of strategic planning in the efficient use of resources in city is causing serious pollution problems and energy shortage in the Nation. The Nation is now spending more than US\$200 billion a year to treat the pollution problems, which is 10% of the GDP. Exhaust of pollutant causes high penalty to China's economy. Acid rain endangers the balance of our fragile eco-system and causing erosion of agricultural land.

Our current city electricity and traffic relies heavily on burning of fossil fuels. Carbon dioxide emission and air pollution due to the current petroleum powered electric supply is endangering the Nation's eco-balance and health. The CO₂ emission of China has topped and overtook the U.S. in emissions of CO₂ by 8%, according to report of Netherlands Environmental Assessment Agency in 2007. China's CO₂ emission contributes to the global warming and threatens human existence; it is also a potential threat to the Nation's international political situation (Kyoto Treaties).

The cost of air pollution is not only on the economic side. Many valuable heritages in China are under treat of disappearance due to pollution related erosion. The Yungang grottoes, a renowned cultural heritage of high historical and art values in the Shanxi is disappearing. Acid rain erosion is damaging the stone carving as a result of or air pollution of the neighboring coal mines. The loss due to damage to the cultural heritage cannot be measured by financial lost.

Lack of waste treatment facilities planned in major cities to treat the solid waste produced is also serious. Among cities in China, Beijing, Shanghai, and Shenyang are the three largest waste producers, yet recycling rates remain quite low in these cities. In Beijing, we can find numerous waste storing and sorting place on the 5th ring.

Currently, there is lack of central planning on solid waste treating. Landfill at peripheral of the city is often seen causing land pollution and destroys eco-balance and waste of land resources. According to CCICED report, "landfills of solid waste have already rendered 50,000 ha of land around cities useless." Solid waste from all sorts of activities in urban area including household, industry, commercial activities amounts to 190 million tons a year in 2004 and is still increasing. Recycling and waste treatment facilities need be planned ahead to tackle the current problem and to prepare for the future increase.

The energy crisis is becoming more apparent lately. Shortage of energy is closely related to the current inefficient energy use inherent in the China city structure. The Nation is suffering from consequential effect of energy crisis on economy and national political relationship can be observed from the following phenomenon.

- Insecurity of energy supply causing blackout of power cuts and rationing in large industrial cities. Foreign enterprises have to cut production in China to diversify the risk.
- China's energy provision presently depends on oil import from countries in Middle East (45%) and Africa (29%).
- Political conflict with other countries, due to the competition of energy supply, affecting China's world political relationship.
- Lack of energy reserves and insecurity of energy supplies is the main problem constantly faced by China leaders. The present energy reserve of the PRC government can only support 30 days.

It is essential to review the city structure and increase the efficiency of the city, or the country resources cannot sustain in the long run.

Conservation of major national heritage is affected by the urban growth

China has a long history of urbanization. For example, Beijing has 500 years of history. A city in China not only contains heritage buildings, the very form and spatial structure of ancient cities organization bears cultural meaning to the nation. The Forbidden City in Beijing is also a heritage site by UNESCO. Beijing, maintaining its status of a major city in China, its dual identity of cultural and economical role causes discussion on the dilemma of conservation and development.

Conservation of numerous ancient cities in China is now facing conflict with economic development. These heritage sites are endangered on both the change in economy, context, and pollution. The low density old city cannot sustain both economically without urban renewal, change in context is threatening the spatial hierarchy of the historic site and pollution is eroding major heritage.

As mentioned above, the Yungang Grottoes is suffering from acid rain erosion caused by neighbouring coal mines. The invaluable stone Buddha carving which has stood for 1500 years is now endangered. Strategy to conserve architectural heritage under the current city development is urgent but difficult to formulate.

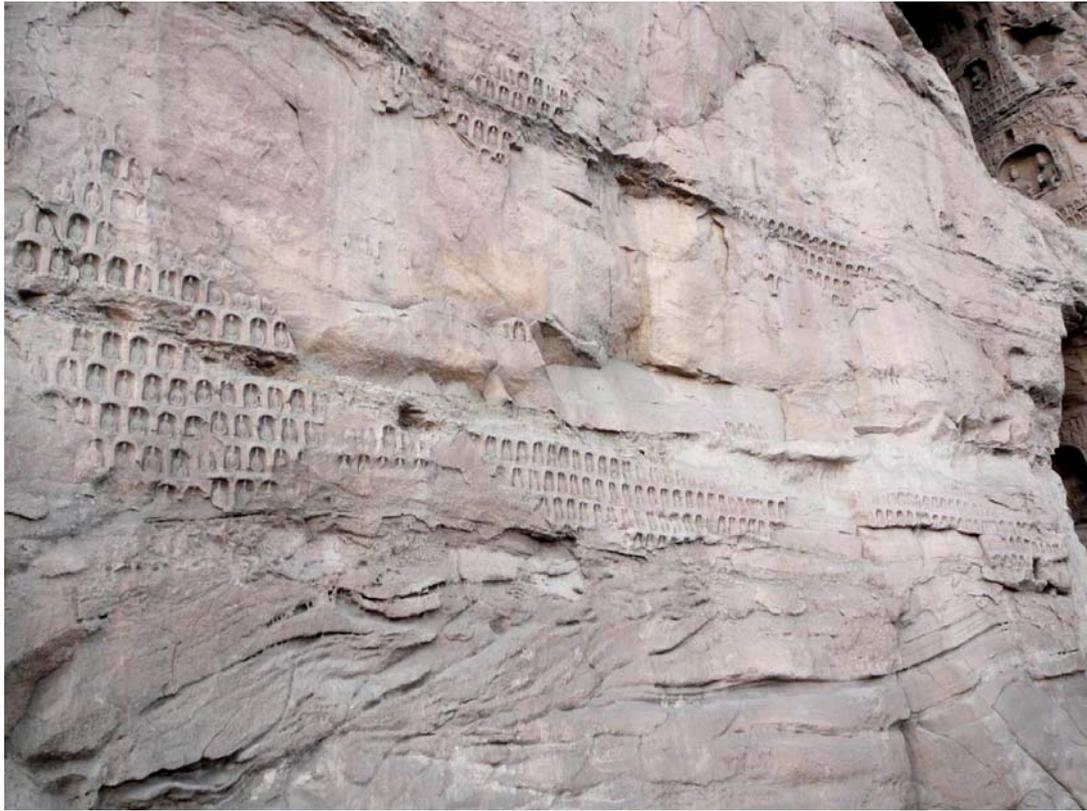


Figure 6 The eroding Yungang Grottoes

2. Zoning and Urban Planning Institution Development in China

According to the definition of American Planning Association, zoning is “the division of a city or county by legislative regulations into areas, or zones, which specify allowable uses for real property and size restrictions for buildings within these areas. Also, a program that implements polices of the General Plan.”

Zoning and its conceptual applications in China

From the end of 1980s, planning institutions, including zonings of UK, North America and other European countries were translated and introduced into China planning professionals. From early 1990s, studies in overseas zoning were concentrated in North American institution. And then zonings of Hong Kong, Taiwan and Singapore also came into the view of China’s planners. Consulting overseas zoning experiences, researchers and planners proposed lots of suggestions to reform China’s urban planning institution, or even introduce zoning legislation systems in urban land use management.

However, till now, zoning has not become part of China’s urban planning and management system. On the other hand, zoning concepts and some of the zoning functions are engaged into the original China urban planning institution. Concluded by

Shi (1992), zoning principles are respected in China urban planning institution in two aspects. Firstly, *district planning* was regarded as the hybrid of zoning with China's original master plan. But in the later experiences, district planning was somehow neglected in planning practices. Part of the reason is because of the second aspect of zoning integration, the *regulatory plan* whose contents is much more similar to the zoning itself. According to the *Urban Planning Formulation Regulations* (2005 version), regulatory plan defines land use, size, volume and aesthetical aspects of the development, public services, facilities and infrastructure requirements and relevant indices. But in the same paper, Shi also pointed out that, despite to the political background of these two systems, there are still a primary discrepancy between zoning and regulatory aspects, which is that regulatory is only technical document in Chinese cities. On the contrary, zoning is law. There is a significant difference between their authorities.

Efforts to introduce zoning in China's urban planning management system are also seldom successful. For example, as a pioneer of urban planning institutional innovation, Shenzhen established its unique urban planning system with statutory planning by imitating Hong Kong's case. However, according to Zhang and Gu (2000), since Shenzhen's statutory planning has over-detailed technical contents and is less flexible compared to the Zoning of US, Outline Zoning Plan of Hong Kong and Zoning of Taiwan, its utility is seriously affected. Moreover, Zhang and Gu (2000) has the similar conclusion as Shi (1992). Since the statutory planning is only a local ordinance, which can only be regarded as reference for execution in legal system, its jurisdiction is also quite limited.

In conclusion, to this moment, zoning actually does not exist in China. Zoning principles in land use and development control are carried out by other urban planning procedures. Therefore, following discussions in this paper shall focus in urban development within current China land use or urban planning context instead of zoning background. On the other hand, since there is no zoning legislation system in China, so the control power of urban planning is weak. It causes lots of challenges in urban development, which shall be discussed in the later parts.

Urban landuse and planning before 1980s

After the establishment of the People's Republic of China, urban planning institution of Soviet Union was adopted in China in the beginning of 1950s. Supervised by the Soviet Specialists, urban planning was only defined as very limit functions in industry projects locating and planning for the construction of these factories and their service areas. This kind of factories and their service areas always combined together and eventually created a small 'town' with a whole set of urban infrastructure and social services. This kind of landuse and urban development paradigm, which is called (*working unit*), also be followed by other national organizations, such as government agencies, universities, institutions and so on. Governments provided the units a piece

of land for their own development. Even different from the industry projects, those land parcels allocated to the self-constructed units was not prescribed by any kind of planning, and caused many troubles for urban renovations during later times. Under such circumstance, planning applications from zoning aspect was totally not practicable.

After 1960, under the extreme political context of Cultural Revolution, urban planning development was suspended. Before the late 1970s, urban constructions in China were quite slow or even intermitted. In March of 1978, the Third Meeting of Urban Tasks held by State Department announced the significance of urban planning, and this announcement was recognized as the recovery of urban planning in China. In 1980, the National Construction Committee indicated that urban planning is the blueprint of urban further development and management. Urban planning gradually returned to its original utilities in China.

Stabilization and Legislation during the 80's and 90's

After the recovery of urban planning institution, there came a wave of urban planning development. On one hand, Chinese planners are responsible to plan the vast country which was mostly rural at the time. On the other hand, after the isolation from the domain knowledge of planning for around thirty years, lots of international and overseas planning theories and methodologies were developed and were suddenly introduced to China. Planners and researchers were also enthusiastic in academic discussion of the planning professional topics. Through the experiences of a decade, urban planning in China entered a stable period.

There are two milestones of urbanization in this period, which were legislations of urban planning institution. In 1984, *City Planning Ordinance* was enacted. And then in 1989, its successor, the *City Planning Law of PRC* was legislated. These legislations designated the system of urban planning institution into two general categories, which are master planning and detailed planning. For large or medium-size cities, district planning may also be suggested. Ministry of Construction then issued the *Urban Planning Formulation Regulations* in 1991 for detailed implementation instructions. Through this legislation process, urban planning institution in China, which can accomplish most of the zoning functions, was officially launched.

Other Technical and Theoretical Developments

From mid of 1990s, after the stabilization of planning and zoning institution and maturity of planning methods, urban planning methodologies in China became more diversified. By reviewing the major publications and journals in planning domain, one of the main trends is a deeper investigation on planning support mechanism. During this period, scientific approaches, multi-disciplinary investigation and research-based planning became a focused topic in China planning professionals. Reliability, validity

and utility of urban planning are also considered to review the planning decision making process. This trend of enhancement of scientific and multi-disciplinary planning decision making support accelerates the institutional planning theme studies in the later time, which is playing a very important role in current urban planning procedures.

New technologies are also introduced vigorously to support planning in China after the end of 1980s. Chinese planners, maybe with their overseas colleagues who provide practical technical supports, began to enthusiastically explore CAD, GIS, RS and relevant technology applications in planning. Several researchers even investigated artificial intelligence analysis in early 1990s. However, progress on those technology explorations in the past 20 years is not satisfying. Although there are significant innovations in municipal management aspects, but planning and zoning process itself still has not gained much benefits from these technologies. For China, there are still extra efforts needed to explore the new methodology in order to integrate the technologies into planning process.

Concerns on resources and ecology are another significant change after the late 1980s. Planners and researchers in China also proposed their original theoretical propositions or planning methodologies, like “Shan-shui City” and “Negative Planning”. But more significant changes happened in recent years. The national policies on sustainable urban and regional development and green architecture are announced, and resource and environmental concerns are gradually proposed. As the consistency in zoning and planning institution, resource, ecological and environmental plan has becomes an essential urban planning procedure. Such trend can also be illustrated by the revision of *Urban Planning Formulation Regulations* in 2005, in which the ecological and environmental resource management and protection has been indicated as one of the basic functions of zoning for the first time.

After mid 1980s, based on the development and Pearl River Delta and Yangtze River Delta, planners in China also began to consider the regional development and regional urban network. In this field, Prof. Wu Liangyong, who is a significant contributor to the regional planning on the two above-mentioned regions as well and Bohai Ring Region, is the key pioneer. From zoning perspectives, Chinese researchers and planners enlarge the planning scale to the regional level. It is able to improve consistency among cities in recourse management as well as economy and markets. From mid 1990s, enormous regional planning topics emerged in the planning professional discussions. It is just coherent with the background of the second wave of rapid development in China. It also corresponds to the global development movement in both economy and regional development. In recent years, planning researches on the regional harmony of China mostly concentrate on sustainability issues to reflect the national policies.

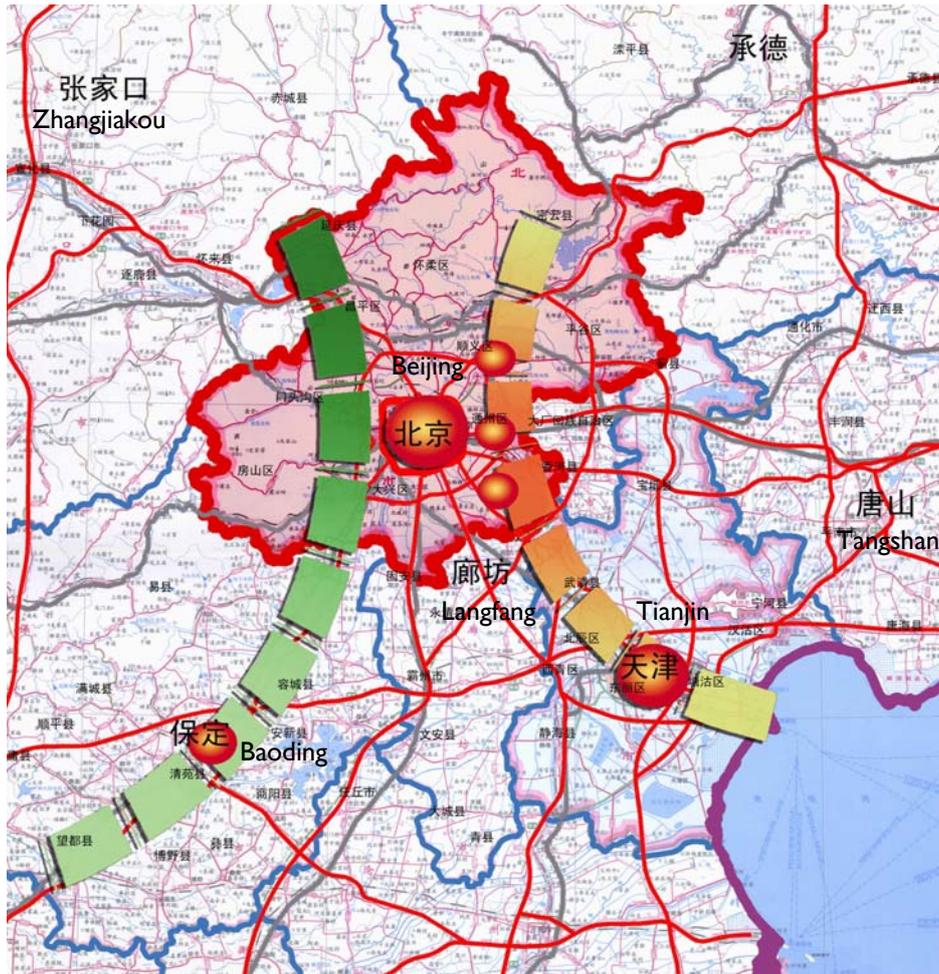


Figure 7 Regional development of Beijing Master Plan for 2004-2020 (Source: Beijing Municipal Government)

Towards the end of last century, planning paradigm is also gradually developed in China. Besides the zoning concept adaptation in the urban planning institution in district planning and regulatory plan, Chinese planners also explored strategic planning, concept planning, and so on to enhance the performance of institutional planning procedures like immediate plan, in order to improve the investigation on planning details as well as operational utility by particularity divided planning procedures. Other planner groups provide opposite approaches to integrate the procedures into more comprehensive framework to ensure the consistency, like integration of urban master plan and land use planning. The Tongzhou New Town Planning case which the author contributed in 2005 is an example of this kind of exploration.

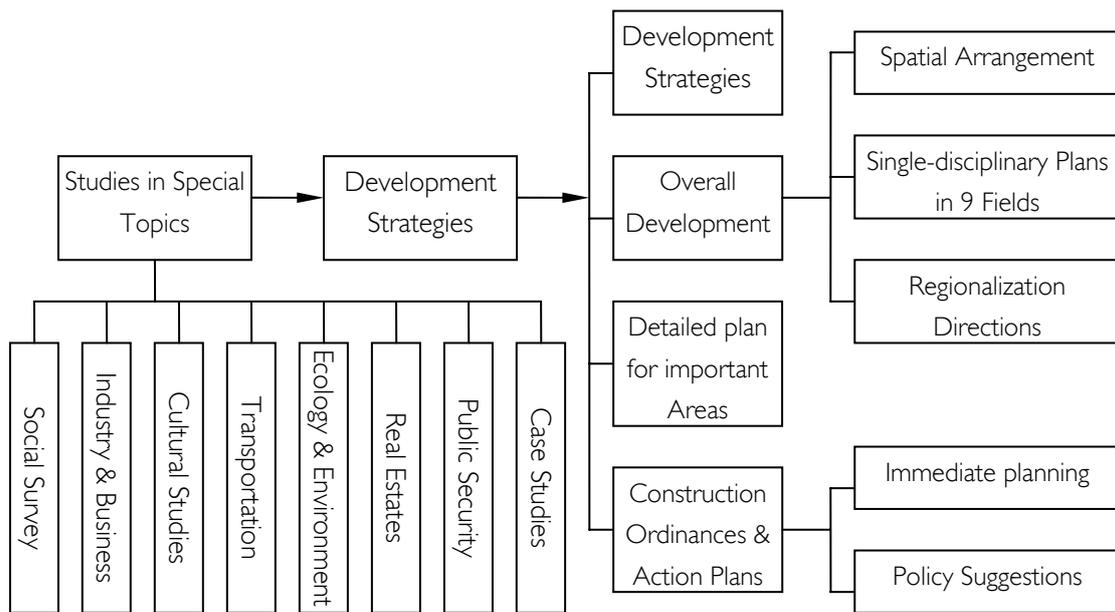


Figure 8 Tongzhou New Town planning framework (courtesy of China Academy of Urban Planning and Design)

3. Special Issues and Challenges

Contradiction and Unfairness of the Change Use of Farmland

Farmland lost has been an extremely serious consequence of rapid urbanization in China. According to the national statistics data, at the beginning of Reform and Open-door Period, farmland lost is around 4913 km² per year from 1981 to 1985. Farmland lost in 1985, which is in 10092 km² became the peak of the past ten years. Then the situation is somehow under control. But from 2000, the situation has become worse. Another peak of farmland lost in 2003 reaches 25374 km². Average farmland resource for each people in China has already lower than the critical point to maintain the national food supply security.

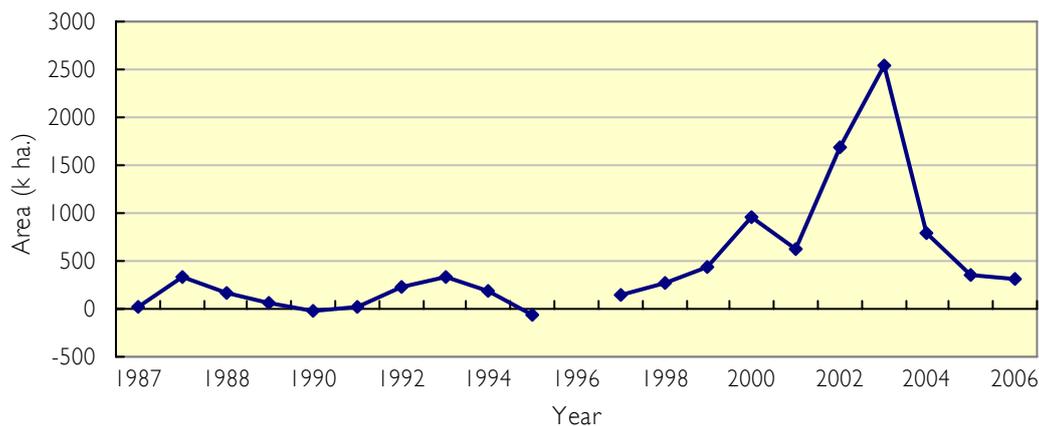


Figure 9 Farmland lost in China from 1986 to 2006 (Source: Annual Reports of National Bureau of Statistics and National Land Resource Reports of The Ministry of Land and Resources, P.R.C.)

Urban development is the most important reason for farmland lost and urban sprawl. For example, around the peak period of farmland lost, urban construction areas and land acquisition also increased tremendously. Urban construction land use increasing in 2001 is double to the average level of 1991-2000. And then reaches to 2.5 to 3.5 times in 2002. On the other hand, efficiency of those new urban area developments is quite low. From the example of 2004, there are 263.7 km² undeveloped lands within the urban construction scopes of the whole country, which equals to 7.8% of the entire urban contraction lands of China and even higher than the annual urban contraction land use increase rate in 6.5%. Out-of-order in land acquisition and low-efficient land development caused serious problems in farmland reserve. According to Ministry of Land and Resources, amount farm lands occupied by no-agricultural land use in 14 provinces and municipalities of East Coast of China has been all beyond the planning indices. In some extreme cities' cases, land reserve for 2010 even had been already exhausted in 2001.

Securing food supply to satisfy the Nation needs and stabilizing farmers on social issues are two important agenda which get carefully looked after by government administrators. For example, during the early stage of economic reform (1980's to 90's), the key difficulty faced by the farmer in China is the heavy tax that they were imposed upon. Although farmers have a very low income standard comparing with the knowledge workers in major cities, from time to time they need to pay about 8% tax from their annual income about RMB2,000. At the beginning of this century, China government decided to remove this tax from all farmers in order to provide financial help to them. However, the interest conflict between local government and farmers on the land acquisition of farmland has become the new focus of the Nation, the basic right and daily living have been impacted by the farmland acquired by the cities for the urban expansion purpose.

One key problem of the acquisition process of farm land is the extremely low compensation; in some cases farmers could only receive few hundred RMB for each acre of farmland. Although the law has clearly defined that the land use change of the farm land should not affect the living standard of farmers, this condition can not be maintained by the city government in most cases. In order to protect their own benefits and right, farmers often take group actions to against the acquisition process initiated by the local government, and local governments often take severe legal action to crack down the actions of farmers.

The central government has noticed this serious land use problem long time ago, and different government agencies have implemented regulations and monitoring process to protect the interests of farmers. Institutionally, land use change is controlled by both land recourse planning and urban planning. Permissions come from both lands provision mechanism and development authorization. Researches of the governments as well as individual scholars has pointed out that the land use change under such double-layers control is efficient for balancing urban development and its negative effects on agriculture. On statistic data of year 2005 may also support this conclusion: according to Ministry of Land and Resources, farmland occupancy by urban construction under the jurisdiction of land use plan is only 31.7% of the all farmland lost.

Unfortunately, the outcome of these approaches has lost control on this issue; the main incentive for local governments to carry out farmland acquisition is to get land resource to pursue “political achievement” projects or to get extra incomes. The farmland acquisition provides the city administrators a legal process to transform group-owned farm land to state-owned land under the control of the city government, and the city could allocate state-owned land for constructing landmark projects or through land auction process to give the land to land developers for the purpose GDP growth or taxation.

Researches also indicate that the main reason of the decrease of farmland is those land acquisition beyond the legal or institutional land supply procedures. Another investigation illustrated that every year in Beijing, new urban development areas is three times more than the annual new land supply for constructions under the lands and urban planning. Investigations in some other provinces showed similar matching rate. Those “illegal” land uses are mostly processed by “renting” instead of legal lands acquisition. More hazardous still, those processing are organized activities by local governments. By renting lands from the farmers, the government can avoid all the rigid requirements and procedures to speed up proposed development. The sooner the development implemented, the lower development cost and the earlier the benefit from the lands (as well as the tax income from the development project itself) derived. Moreover, the compensation from the Central Government for the land use change balance can also be avoided. Those potential benefits encouraged these illegal land

use activities.

Since the cost of primary land acquisition is relatively low, land sale for profits has become one of the main mechanisms of land use changes. “Urban Affair Business” in China is synonymous to land sale. During the first half of 2002, the accumulated total income generated from the land use transfer fee of all cities is around **RMB600B** because of the booming of real estate market. For some East-Coast Regions, like some cities of Zhejiang Province with better economical development, taxes directly gained from newly-changed land use and taxes derived from development projects on these lands may reach to 40% of the local government budget revenue. Land sale may also earn around 60% of the total extra incomes besides the government budget. Therefore, there is more than half of local government earnings are from the land relevant incomes. Pursuit of huge profit caused difficulty in the control of farm land use change and urban sprawl. On the other hand, owing to the large amount of profit generated from the land use change operation, many cities have shifted their focus or attention from providing quality urban planning and design to “urban affair business”.

Under the context of this “land occupying” game through farmland acquisition, city governments, developers and farmers are three major parties which have very different interests. Both city governments and developers have benefited greatly from the process, but farmers have not only lost their land but their job and self-respect. In recent years, the total reduction of basic farm land of China is about 58M acres, and the loss of each acre of farm land will create 1 to 1.5 landless farmers. It means 58M to 87M landless farmers have been created by the un-controlled farmland acquisition process initiated by cities, and stability of China society is being seriously affected by this phenomenon.



Figure 10 News photo: demonstration of land-lost-farmers in Shandong Province. Texts on the banner are: “We have to cultivate for our foods. Please give my lands back.”

Regional Zoning under the Unbalanced Natural Resource and Urban Condition

Energy, land, and water are the three main factors to support urban development, and the sustainable planning of China cities are closely influenced by the availability of these resources because of the regional difference. Among all these, shortage of stable energy resource to support the urbanization process and economy growth has become the key concerns of the Nation. In Year 2004, the total energy consumption of the China equals to about 1.97B tons of coal, comparing with Year 2003, there is an increase around 15.27%. For the petroleum based energy consumption reaches 0.313B tons, but the domestic petroleum production can only contribute 0.175B tons. 0.138B tons depends on the import, and the challenge will be even tougher because of the large amount of floor area is under construction with the 0.8% urbanization growth per year. Securing the stable petroleum supply has become one of the highest priority items of the Nation.

Table 1 Population, economy and environmental conditions of China and 14 other major countries (Liu and Diamond, 2005) *

Country	Population total (millions, 2003)	Annual population growth rate (% 2003)	Ratio of growth in household numbers to population growth (1985-2000)	Average annual GDP growth (% 1999-2003)	Ranking of environmental sustainability index (1-142) ** 2002	CO ₂ emission (metric tons per capita, 2000)	Total CO ₂ emission (million metric tons, 2000)	Per capita ecological footprint (global ha per person, 2001)	SO ₂ per populated area (1,000 metric tons per km ² , 2000)
China	1,288	0.7	2.7	8.0	129	2.2	2,780	1.5	2.7
Bangladesh	138	1.7	1.5	5.2	86	0.2	30	0.6	0.7
Brazil	177	1.2	1.9	1.6	20	1.8	310	2.2	0.4
India	1,064	1.5	1.2	5.8	116	1.1	1,120	0.8	1.2
Indonesia	214	1.3	1.8	2.0	100	1.3	270	1.2	0.4
Japan	127	0	6.1	1.3	78	9.3	1,180	4.3	1.0
Malaysia	25	1.9	1.3	4.9	68	6.2	140	3.0	1.6
Mexico	102	1.4	1.9	2.4	92	4.3	420	2.5	0.10
Nigeria	136	2.1	2.7	4.1	133	0.3	40	1.2	0.2
Pakistan	148	2.4	0.4	3.4	112	0.8	110	0.7	0.3
Philippines	82	1.9	1.4	4.3	117	1.0	80	1.2	0.9
Russia	143	-0.4	No data	6.7	72	9.9	1,440	4.4	0.9
Thailand	62	0.6	2.6	4.7	54	3.3	200	1.6	1.1
United States	291	0.9	1.6	3.2	45	19.8	5,590	9.5	1.7
Vietnam	81	1.1	1.5	6.5	94	0.7	55	0.8	0.3
World	6,271	1.2	1.6	2.5	-	4.0	24,210	2.2	1.7

* The most populous countries in the world, with at least 100 million people each, plus the four next most populous countries in Southeast Asia.

** 1= most sustainable, 142 = least sustainable, among 142 countries ranked.

The transformation of land use is essential in our Nation's urban growth; however, the situation of land resources is also not optimistic. During the time period of National "10-5" Development Plan, because of the rapid development of social economic condition and the adjustment of farmland policy, the total reduction of China's farmland area is 92.4M acres (1 acre = 666.7 m²) (61603 km²), 18.48M acres (12,320km²) per year. According to the 2005 nation wide land use-change survey, the total available farmland of China is 1.831B acres (1,220,707km²), equal to 1.4 acres (933.98m²) per person, around 40% of the international standard. Meanwhile, among the total area of the city or township planning zone, there are around 3.93M acres

(2620.1km²) land which have been kept vacant without any use.

China is in shortage of water, and the water resource per person is about 1/4 of the international standard. Affected by the monsoon season and geographic characteristics, the distribution of the water resource is also unbalanced and the development cost of new water source could be very expensive. Although in recent years the China government has encourage public facilities or housings to actively implement the water recycle or rain water collection system, the reduction of the water demand is minimum. 2/3 of the China cities are under different degree of water supply shortage, and water safety has become another issue requires attention from municipal government because of the water pollutant.

Not only the natural resource affects the regional zoning, but also the existing rapid urbanization has also created new challenges to the living quality of urban settlement. First, under different geographic conditions, the quality of human settlement of different regions has major difference. In the East part of the China, about 42.9% of the land lives 94.2% of the population; but the West half of the Nation, about 57.1% of the land lives only 5.8% of the population. Especially, most of the industries and infrastructure installations are located in East part of the Nation. Natural resource of the West has been use by the East to support the social economic development. Second, the urban pollution problems caused by the rapid urbanization process have threatened the city's future. The RSP and NO_x measurement constantly exceed the health standard, and the optical thickness value of aerosol is high for the high-density urban development zone. For example, Hong Kong has announced the "Blue Sky" action to draw public attention on tackling this issue. Third, the available urban land is disappearing rapidly because of the amount of city construction projects, especially for the water surface and the wetland. Without defining the roadmap on eco-friendly urban development, the unbalanced eco-urban condition has become the major concern to achieve high living quality in urban planning process.

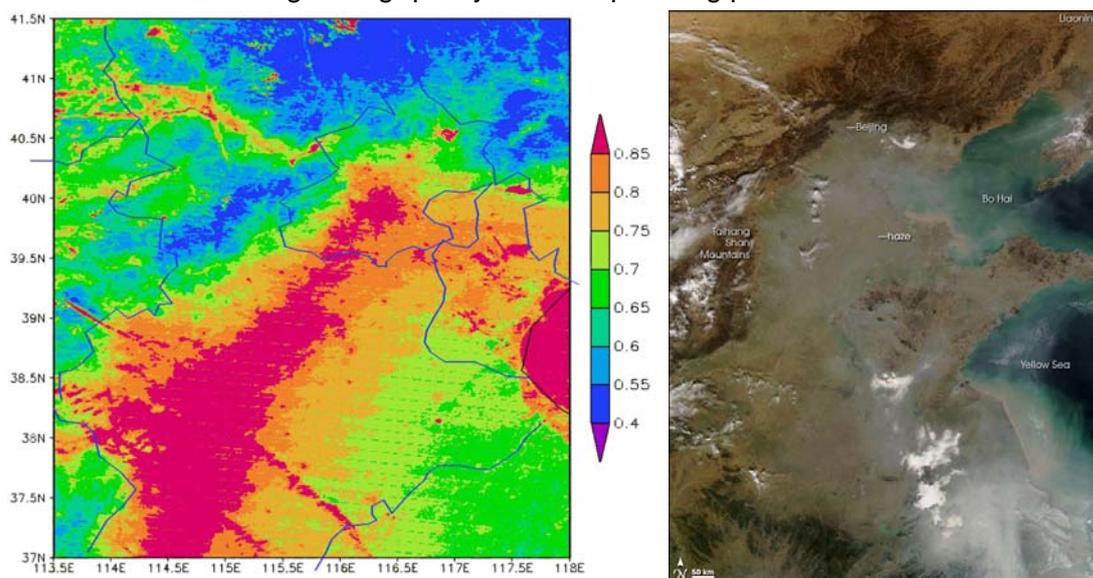


Figure 11 Regional air pollution of Beijing: aerosol optical depth map on February 3, 2002 (left)

(courtesy of Chinese Academy of Meteorological Science); MODIS image of haze over Eastern China on November 2, 2006 (right) by NASA

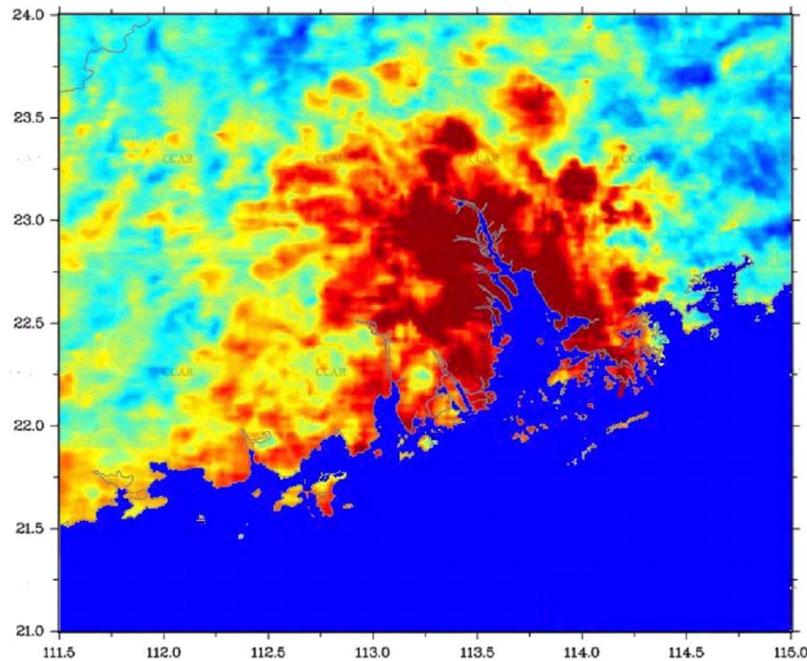


Figure 12 Particulate Matters on November 2, 2006 of Pearl River Delta (Courtesy of Environment Protection Department, HKSAR)

Urban Transportation and Sustainable Development

In 2004, 661 China official cities have total length of the city roads 223, 000 km with the total road areas 3.53M km²., and China is ranked the fourth of car production around the world. The central and local governments also provide low tax approach to boost car purchase in order to assist economic growth. However, the fast increase of total number of car has created serious problem and loading on urban transportation system, and indirectly contributes to the air pollution and living quality problems. For example, number of cars in Beijing has reached 2.35M, and 90% of city roads have reached or exceeded the maximum design capacity. This situation is especially problematic for the roads located inside the Second Ring, and under the normal condition these roads could only provide the car average speed 18km/h because of the traffic congestion. If there is any severe weather condition or accident, the city could easily get into serious traffic break-down situation because of the extremely low remaining transportation capacity. In general, four key factors have contributed to China urban transportation problems.

Firstly, there is a clear gap and mismatch between the provision and standard of city road system and the practical needs to service the cars in the city. In 2002, city road density of China cities is about 7.37 km/sq.km, and the ratio of city road coverage area to the entire city area is only 9.1%. The roads located in the old urban district of many cities are comparatively narrow, and cannot work together to form proper road

system in order to increase the efficiency.

Secondly, owing to the shortage of financial resources or the difficulty to acquire land resources of many cities, the establishment progress of public transportation system is serious behind the development of urban districts. And, most of the city's public transit system cannot work together with other public transportation means to form a structured transportation service framework. Just short time ago, the total city mass transit service distance of China cities is about 300km, and this number might be less than the service distance of London. With this important factor, the growth of private cars in the major cities has caused an unbalanced transportation development pattern. Meanwhile, for the taxation benefits of the city, some cities have increased the number of taxi dramatically. This policy has further worsened the efficiency of city transportation system and caused pollution problem.

Thirdly, lacking major financial investment on the public transport, applying public transport to solve the urban transportation problem has lost its strategic position. The rapid growth of private cars has overrun the public transportation policy defined by the cities. According to the experience of the cities of developed counties in developing the city public transport infrastructure, a city needs to maintain the financial investment at the GDP level 3% to 5%. Based on this figure, most cities of China fall short on the public transport investment.

Fourthly, the poor efficiency of the city road system has indirectly accelerated the air pollution and urban noise problem. Public health and hygiene related concerns on the emission of pollutant by cars have become a serious challenge facing by China cities.

Public Health Concern in High-density Living

High-density living urban environment has become the development pattern in China, and this situation has been accelerated by the non-skilled workers or farmers moving from the farmland to the city. Other than the environmental and natural resource challenges, maintaining a healthy living in the city has been recognized as one of the major concerns in urban planning and design. However, this phenomenon is not unique to the transformation process of China cities, many cities in Europe have also gone through similar experience during their early stage of development.

At the mid 19th Century, in England, around 50% of the population lives in the cities, and new industrial cities have been established rapidly nearby the coal mine areas, cotton factory areas, and major seaports and with the special name "mushroom town". All these cities adopt high-density development approach, and new buildings have been constructed without going through proper planning and design process. Municipal infrastructure and service provided can not handle the growth of the population generated from new city immigrants, and the need for modernizing the management system for a high-density city has not been recognized and structured.

The urban penalty in pollution and public hygiene has clearly demonstrated the seriousness of the living environment of these cities, and the economy and growth of these cities have been damaged by the breakout of infectious diseases in 19th Century. Learning from this important experience, new legal procedures and laws have been setup and introduced in order to regulate the high-density development and urban growth to protect the public health and to maintain livability of urban environment.

Unfortunately, a lot of these experiences from Europe cities have not been introduced or recognized to the city administrators, developers, planners, and city citizens in China, such as the “urban village” problems happened within the rapid growth sea-coast cities or SEZ. Public hygiene, health, and safety have generated major impact to the economy growth in these districts. Toward to the end of 2002, Guangdong Province, China, discovered the first SARS case, and in about 5-month time, more than 5000 cases have been found in 27 provinces. In Hong Kong there are more than 1700 cases got detected and 298 patients lost their life. This sudden public health incident has caused major financial and psychological impact to China and HKSAR. The economy loss caused by SARS incident to Mainland is close to US\$17.9B (GDP 1.3%), and to Hong Kong is about US\$12B (GDP 7.6%). Especially for some sector of the society has suffered the most, such as real estate, retail, tourism, airline, construction, etc. No doubt about it, SARS incident has given the international city like HK a clear signal on the potential penalty caused by infectious disease, however, SARS is a kind of infectious disease with rather low Basic Reproduction Number comparing with other deadly infectious disease according to the medical scientists.

Learning from the SARS experience, various measurements, guidelines, and mitigation methods have been introduced by the government agencies to look after the public hygiene, for example, the establishment of infectious disease control center, the development of infectious disease warning system, or the environmental design assessment requirement. However, one important issue has not been addressed with focused review or study is high-density urban development pattern adopted in China, and this development pattern challenges the safety and health of China cities.

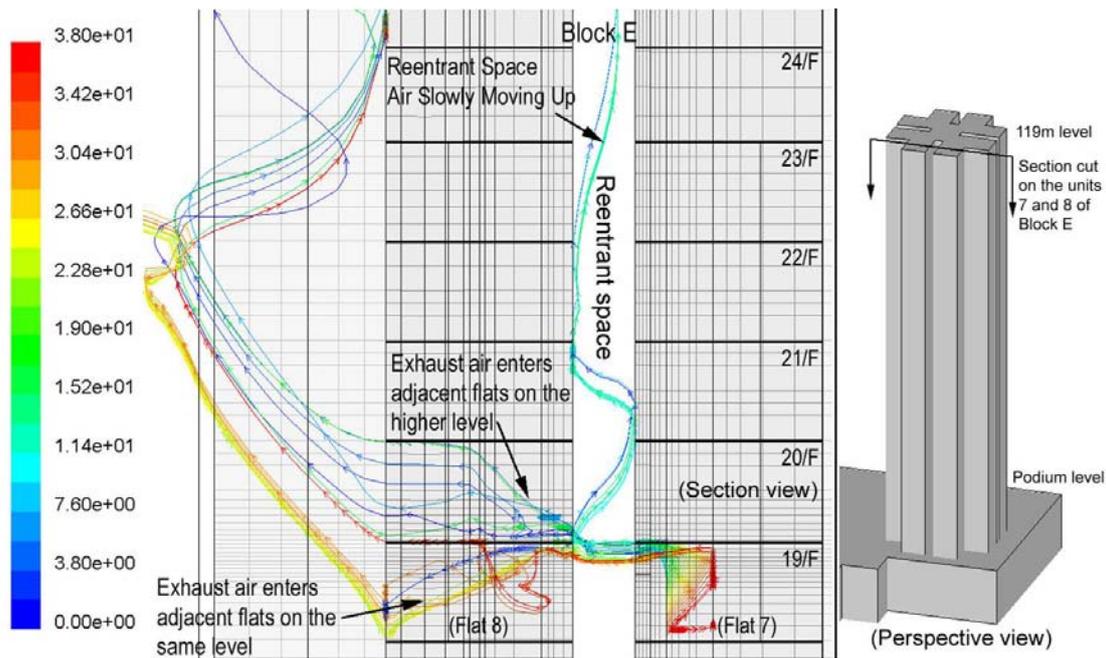


Figure 13 SARS research by Center for Housing Innovations, CUHK: simulation of SARS inflection through air flow in Amoy Garden of Hong Kong

Housing for Billions: Affordable-economical Housing

The China real estate market has been under rapid development in the past few years. The growth rates of real estate investment are 19.5% (2000), 25.3% (2001), 21.9% (2002), 29.7% (2003), and 28.1% (2004). The total amount reaches RMB 1315.8B, and it has pushed the energy use and resource allocation to the limit and caused major concerns in the planning and development of cities. Meanwhile, the housing price is also going up rapidly, in 2004, the average housing price goes up about 14%, and the price of housing in the East region goes up 16.4%. Since real estate development directly affects national economy and social sustainability, several new housing policies and pricing control mechanisms have been introduced in order to reduce the “overheat” problems of real market in major cities in 2004.

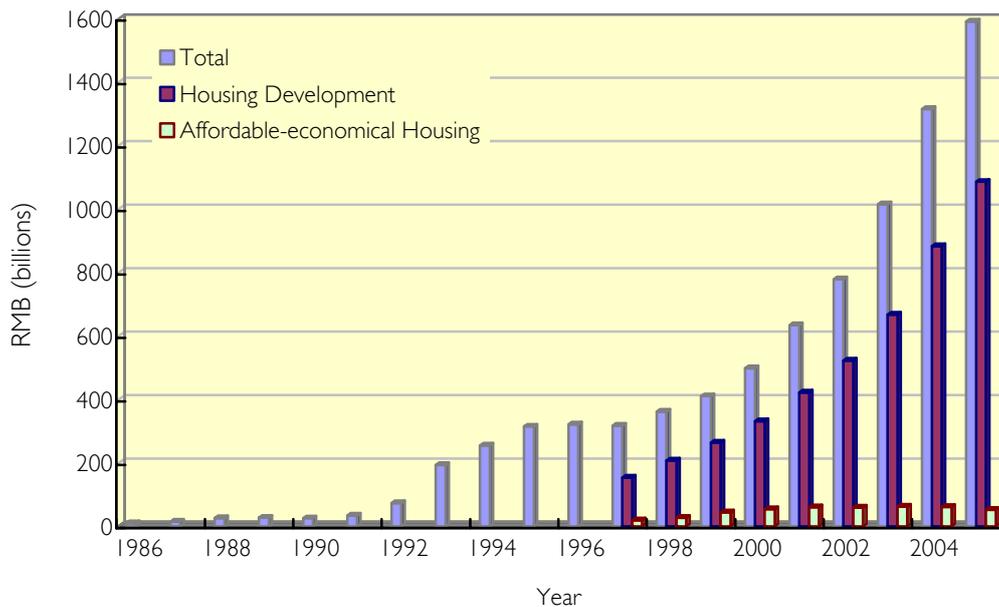


Figure 14 Urban real estate investment in China from 1986 to 2005 and housing development investment in 1996-2005 (Source: China Economy Yearbooks)

These control mechanisms include: a. Re-organizing and re-structuring the land leasing market, especially on the change use of farmland; b. Strengthen the control of home loan and credit system; c. Checking the large size financial investment on property development projects (e.g., convention center); d. Increasing the percentage of capital investment of housing projects (35% or above); e. Regulating the number of housing demolition located at inner city. In order to control and regulate the real estate market further, in mid 2005, a comprehensive housing pricing control guideline is issued by the China State Council through Ministries to further stabilize the housing provision and pricing. In this round of pricing stabilizing mechanism, the mitigation measurements have been applied on both sides of housing demand and housing supply, and the new housing policy is also released by Government to guide the development direction of the housing market.

Policy and guidelines have been announced on four key areas:

a. In urban planning and land allocation process, priority is given to the development of low or middle-low class commercial housing and affordable and economical housing. Municipal government is required to apply administrative methods to provide sufficient land to support the implementation of these types of housing, and on the same time to control the land supply to high-class commercial housing. Meanwhile, the city government is requested to carry out actions to reduce the “undeveloped” housing project sites and control the illegal transfer of state-owned land in the city.

b. The new taxation regulations or other financial means are introduced to increase the housing pricing control capability of the government against the speculation based

financial investment on housing market. For example, full tax rate is applied to the total income of the transaction of individual purchased housing which is less than two years from previous transaction.

c. In the housing provision policy aspect, special subsidizing arrangement, land provision, and tax benefits are provided by the local government to encourage the development of affordable and economical housing and low-income housing. Low-income rental housing projects and policy have been implemented by the local government throughout the Nation to take care and address the needs of the low-income social group.

d. Stringent measurements have been applied to prevent the property transaction of unfinished commercial housing units, and to prohibit any illegal method on marketing or selling commercial housing projects.

Other than housing pricing issue, the resource-conservation type or environmental friendly type of real estate development and housing design has become the main direction to lead the urban context and living environment of China. For example, under the consideration of characteristics of different climatic zone and public hygiene requirement, the density and plot ratio have been reviewed by city planning institute for the possible increase of these control parameters to improve the efficiency and effectiveness of urban land use. However, the new approach is not limited at the housing estate level alone, together with compact-city urban planning and design concept, the city administrators have been asked to take considerations at macro-scale to integrate housing development with other factors such as, transportation, public facility, infrastructure, urban green, etc.

The planning strategy for housing estates in the urban sites has also been changed. The overall layout has moved from “enclosed” approach to “open” approach for improving the integrity of urban context and avoiding the “city island” phenomenon. In the past twenty years, a pattern has been established for the planning of housing estate projects such as building up a boundary wall to separate the estate from the rest of urban external space system. Although the estates have very good packaging, community facilities, open space, pedestrian walkway system, landscape layout, and circulation system, each estate is a self-confined city unit without interconnection and linkage to the rest of the city grid. This situation not only causes inconvenience of the residents living inside the estate, but also creates serious problems of traffic jam around the neighborhood, community facility sharing, and different income group segregation issue in a city. Future planning and design of urban housing estates in the city does require comprehensive consideration not only from the estate development level but also from the sustainable urban development level.

4. Remarks

Fundamentally there are two factors challenging any planning or zoning related policy making: the size of the base is large (i.e, 1.3B population); the geographic condition is diversified. Any planning policy made not only needs to be representative and comprehensive enough to guide the direction of Nation's future urban development, but also need to be able to take care of the regional social-economic difference. Owing to the historic reason, as we have addressed in the paper, China is in the progress to establish her own comprehensive planning and zoning control mechanism framework, and the planning control is still not at the central stage of a lot of city planning or regional development process. Since the legal systems of land use control and planning are separated in different administrative groups, the implementation of planning regulations at the urban planning level is not efficient and effective.

Challenged by the limit of natural resources and environmental problems, multi-factors and multi-disciplinary approach is one important future direction of China's planning method. Developing scientific control, monitoring, and evaluation methods to support the urban and regional planning decision is crucial, because it will become more difficult to achieve a balanced solution because of the complexity of urban problems and the inter-system relationship of involved factors. Facing this upcoming challenge, innovation of current approach is importation and necessary, and it is also crucial to educate qualified urban planners and administrators who could carry out critical integration and total spatial management for the Nation.

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