

Slow-Moving Traffic and the Built-Environmental Design

1. Introduction

China's post-reform urban expansion since 1978 has taken the shape of what scholars describe as the Chinese version of sprawl (Campanella 2008). Specifically, at the regional scale, rapid growing cities have expanded like 'pancake making'—spreading from the old city core outwards at a decreasing level of density. Leapfrogging developments of high-tech parks, economic development zones, university cities, and gated real estates are creating an increasingly fragmented regional landscape. At the local scale, more and more workers no longer live on or near worksites like they used to in their Danwei's (or Work Units in literal translation). The newly built environment in cities across the country have become much alike, featuring super-sized blocks, wide street sections, grand scale plazas, and spacious parking lots. Overall, local communities and neighborhoods are losing identity and the built environment functions more and more friendly to cars but hostile to slow-moving traffic (SMT) by non-motorized modes, namely walking and bicycling.

Academic research in other countries has demonstrated a strong correlation between the built environment and travel behavior (e.g., Ewing and Cervero 2010). This is evident in Chinese cities as well. Accompanying the increase of SMT-hostile built-environment has been the decline of SMT uses. For long China has carried the glory of "Bicycle Kingdom", with one bicycle for every three persons. Yet the glory is gradually fading when bicycling becomes increasingly marginalized. Before the 1980s, the share of SMT accounted for more than 70% in Chinese cities. In recent decades, the share has been declining constantly. In Beijing, for example, the commuting share of bicycling decreased from 58% in 1986 to 38% in 2000, and further to 18% in 2008 (Huang 2005).

What factors contribute to the sprawl-style urban expansion and the dramatic decline of SMT in Chinese cities? Misunderstanding/mistreatment of SMT exist in three aspects. First, conceptually culturally, SMT is believed to go with the lower income. While by economic theories demand for motorization increases with income, other factors such as socio-demographic needs and environmental constraints make SMT essential elements of urban mobility; SMT should not be considered as inferior cars. Second, behaviorally, many drivers drive without much respect to driving rules and regulations. Pedestrians and cyclists also often ignore traffic signals and signs. Not necessarily they act purposely to violate rules and regulations. Rather, their behavioral adjustment to motorization lags behind income growth; when driving they believe they can change lanes, make turns and stop/start cars as freely as they used to when walking and biking. Third, in practice, there have been slow responses from the professionals and policy makers to the characteristics of SMT in the motorization age. More often than not, spaces initially designed for bicycles and sidewalks are turned into car lanes or parking lots and managed by government authorities.

From the demand side, education and law enforcement can help make needed cultural and behavioral adjustments. Developing SMT-friendly built-environment through sensible planning and design represents the needed efforts from the supply side. This paper focuses on a very special topic of built-environmental design, the role of planning standards and codes. In essence, standards and codes can affect development process and outcome through regulation, permitting, and resource allocation. Land subdivision, street layout and width, and configuration of right-of-way, green and open space designation, and sewer and utility provision, all are governed by standards and codes. Studies in the U.S. have demonstrated that standards and codes have strongly shaped American cities, dictating all aspects of urban form (Ben-Joseph 2004). In China the central government adapts a variety of national standards and codes for community planning, design, development, and management. Public agencies and professional institutions must follow these codes in

practice. Provincial and city governments may develop specific local guides; they should be consistent with the national provisions. How do these standards and codes contribute to the making of the increasingly monotonous urban form throughout China? To answer the question, this study analyzed the codes and interviewed a panel of experts. Super-block is the most representative feature of post-reform urban development in Chinese cities. The study thus focused on roadways and street network, which define city blocks.

2. Code Book-Based Analysis of City Blocks

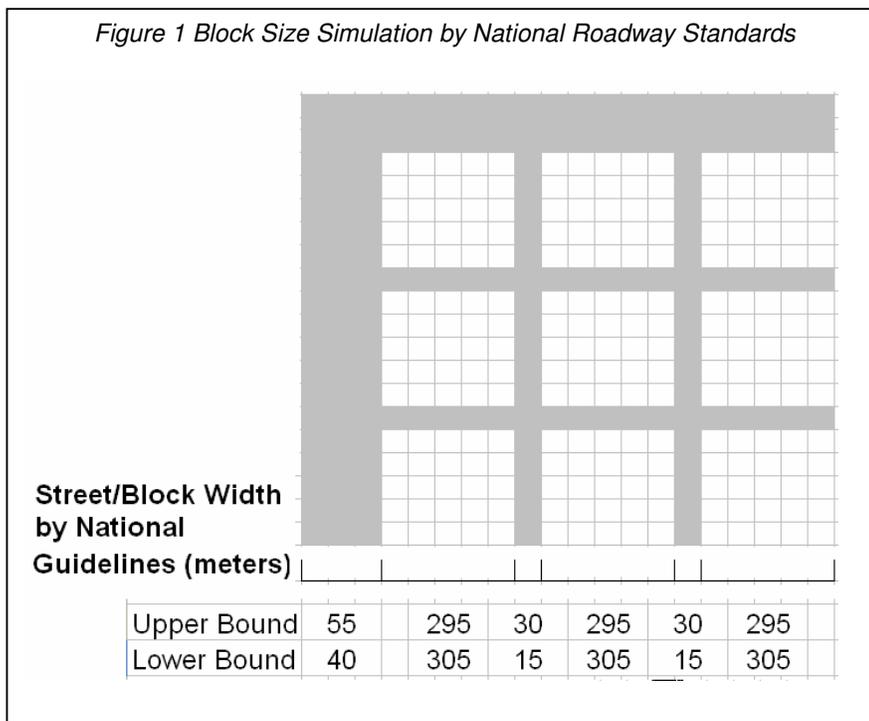
China's Ministry of Construction and other national agencies publish hundreds of standards and codes for planning and building design. Table 1 show the national codes on urban roads specifying design speeds, network density, number of vehicle lanes, and right-of-way (ROW) width. The provisions vary among different sized cities. For example, large cities with population of two million or more should have an expressway density at 0.4-0.5 km in length for every sq km land area. According to the standards, expressway should have 40-45 meter ROW with 6-8 vehicle lanes. For large cities with population between 0.5 ~2 million, expressway density is accordingly lower (0.3-0.4 km/sq. km.) and ROW narrower (35-40 meters) with a fewer number of lanes (4-6). The codes specify no expressway for medium sized city that has a population between 200 and 500 thousand. Similar sets of provisions are specified for other types of roads/streets in the roadway hierarchy, i.e., for arterials, collectors, and access roads. For small cities with population less than 200 thousand, the network contains only two types of roads/streets, arterials and collectors.

Table 1 National Planning Standards for Urban Roadway Network, China

	City Size (Population in 1000s)		Expressway	Arterial	Collector	Access Road
<i>Medium to Large City</i>						
Design Speed (km/h)	Large	> 2000	80	60	40	30
		≤2000	60-80	40-60	40	30
	Medium		-	40	40	30
Roadway Density (km/km ²)	Large	> 2000	0.4-0.5	0.8-1.2	1.2-1.4	3-4
		≤2000	0.3-0.4	0.8-1.2	1.2-1.4	3-4
	Medium		-	1.0-1.2	1.2-1.4	3-4
Number of Vehicle Lanes	Large	> 2000	6-8	6-8	4-6	3-4
		≤2000	4-6	4-6	4-6	2
	Medium		-	4	2-4	2
Right-of-Way (m)	Large	> 2000	40-45	45-55	40-50	15-30
		≤2000	35-40	40-50	30-45	15-20
	Medium		-	35-45	30-40	15-20
<i>Small City</i>						
Design Speed (km/h)		> 50			40	20
		10-50			40	20
		< 10			40	20
Roadway Density		> 50			3-4	3-5

(km/km ²)	10-50			4-5	4-6
	< 10			5-6	6-8
Number of Vehicle Lanes	> 50			2-4	2
	10-50			2-4	2
	< 10			2-3	2
Right-of-Way (m)	> 50			25-35	12-15
	10-50			25-35	12-15
	< 10			25-30	12-15
<i>Source: MOC 1995.</i>					

Figure 1 visualizes street network prescribed by the standards on an assumed featureless plane for large cities. The simulated network produces an average block size of approximate 300x300 meters (or 984x984 feet). For medium and small cities, the standards prescribe fewer number of driving lanes and consequently narrower ROW than for large cities. The average block size, however, is nearly the same among large, medium, and small cities.



A city block averaging 300x300 meters is nearly twice as large as the average block size suggested in the US for typical residential and commercial blocks (Sendich 2006). Yet it is still in a manageable scale for most pedestrians and does not necessarily generate super-block effects. In practice super-block appears when the access roads become inaccessible to the general public either by design or by access control.

Figure 2 illustrates block structure of three neighborhoods in Shanghai, Ba Bai Ban, Kang Jian, and Lu Wan, which were developed in different stages of Shanghai's

development. Ba Bai Ban was built largely in late 1980s and 1990s. It is located in the PuDong New District of Shanghai, less than 5-km from the CBD across the Pu River and 1.6-km to the sub-center of Shanghai, Lu-Jia-Zui. The housing stock in Ba Bai Ban contains mainly commodity housing. It was produced after China's housing reform that introduced the private sector into the housing market and also motivated the state-owned enterprises (SOEs) to become increasingly active in supplying housing as commodity rather than welfare.

Zhong Yuan is located outside Shanghai's inner ring road 10-km away from the CBD to north. It is a typical planned-community built in the 1970s-80s. Residential blocks consist of mostly mid-rise (5-7 story) row houses or towers. Their planning and design generally follow the concept of Neighborhood Unit. In Shanghai these communities are popularly named "Workers' New Village". Schools, retails, and other public service facilities are provided according to the national planning codes that specify perspective service radii or population thresholds for these facilities (MOC 1995).

For comparison, Figure 2 also shows an old neighborhood, Lu Wan. It is located in the city core, only 2.5km from the Shanghai CBD. It is a traditional-styled neighborhood built in the 1930s-40s. Typical residential quarters in Lu Wan are known as Li-Long Housing—2~3 story homes densely laid out along small alleys and featured with red or grey tile roofs. The average block size is approximately 150x150 meters.

The network structure of Ba Bai Ban and Zhong Yuan appears consistent with the provisions of national roadway standards described above. In Ba Bai Ban, city blocks defined by collectors have an average size of approximately 400x500 meters. In Zhong Yuan, collector roads delineate similar average block size of 400x550 meters. Large blocks contain intra-block access roads. These access roads, however, take curve-linear alignments and sometimes end in cul-de-sacs. They work to discourage through-traffic much like those observed in American suburbs. As a result, the actual functioning city blocks become super-sized by design. Figure 3 shows in detail a typical block unit in Zhong Yuan. In many other cases, SOE compounds (i.e., Danwei) occupy one or more blocks of land area. Access to or from the compounds is managed by the SOE security guards, limiting through traffic of vehicles and pedestrians/bikes. Most newly developed real estates are also gated. The kind of territorial control of public access presents a Chinese type of Nimbyism responsible for the formation of *de facto* super-blocks widely seen in urban China.

Quantitative analysis on the above neighborhoods (reported elsewhere, see Pan, et al 2009) shows that SMT and motorized travel do correlate with the form characteristics of the city blocks after the effects of income and others are controlled for.

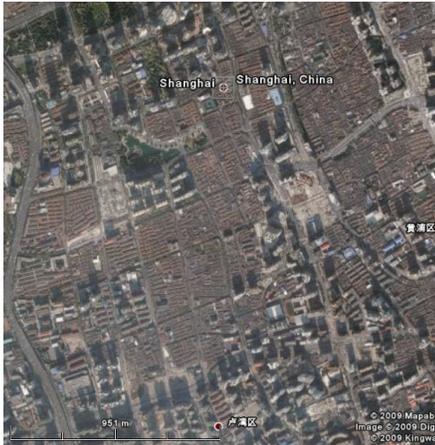
Figure 2 Network Structure in Three Neighborhoods in Shanghai



Zhong Yuan



Ba Bai Ban



Lu Wan

Figure 3 An Example of Detailed Neighborhood Plan in Zhong Yuan, Shanghai

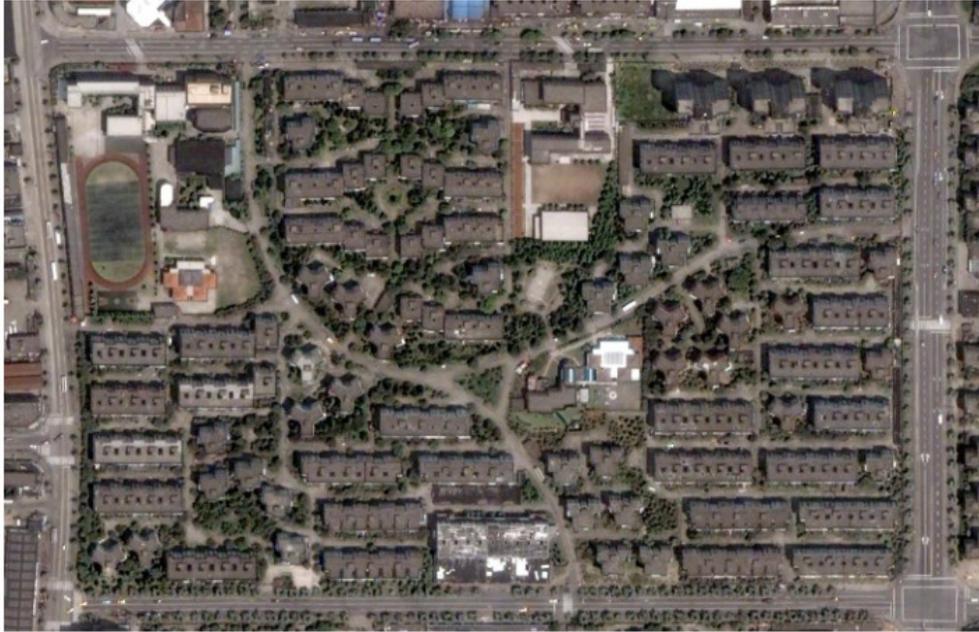


Figure 4 Examples of Super-Sized Intersections



The national standards also specify intersection size. Wide street section and high design speed lead to super-sized intersection, which is common among different sized cities. Figure 4 shows three examples of intersection in Shenzhen (top), Ji'an (middle), and Weihai (bottom), with a registered urban population of 1.06 million, 0.53million and 0.37 million, respectively.

3. Applications of Standards and Codes in Practice

The codebook-based analysis above suggests a possible root cause of the widespread of super blocks across Chinese cities of various sizes. To understand the role these standards and codes, the study identified a number of planning practitioners and scholars and conducted interviews. The following highlight the interview findings.

- China has a strong planning tradition and practice. In general, there are three types of plan-making activities. The first is mandatory by law. Examples of mandatory plans include urban comprehensive plan, city-town system plan, and land use/land preservation plan. For mandatory plans, the national government has specific guidelines on plan-making procedures and on specific products to be delivered. The

second is research-oriented, for example, city-wide urban design plan. The third is project-based, for example, development plan for high-speed rail terminal district.

- Plans and design schemes must follow the standards and codes—it is the bottom line for plans to be approved. Some interviewees expressed that, when they serve as plan reviewers, however, they tend not to scrutinize design schemes by the codes because they trusted that the plan-makers would work by the book. Different aspects of the standards and codes may receive particular attention at times when the central government issues national policy agenda and programs. For instance, in 1980s China's national urbanization strategy emphasized the development of small-/medium-sized cities while controlling for the growth of large cities. Planned population size for the target year became a critical element for comprehensive planning for large cities. Sector plan for housing, transportation, utilities, and public parks would follow national standards based on the planned population limit. Rapid urban expansion in the past three decades has prompted the central government to tighten control over land acquisition for urban development purposes. Accordingly, per capita land consumption has become one of the most important parameters for city comprehensive plan.

Comprehensive plan specifies road network that defines the spatial structure of the city. It contains expressways, arterials and collectors, leaving out specification of access roads. At the detailed plan stage, local access roads are planned to subdivide the area bounded by arterials. Depending on the planned use, there are separate provisions of standards and codes for detailed planning for residential development, industrial district, and public parks and green space.

- Why are super blocks so popular? What is the role of the planning standards and codes? A variety of stakeholders are receptive to super blocks. Local government officials tend to favor super blocks overwhelmingly. One motivation is 'image building' as the media often reports. In the eyes of local officials responsible for urban development, super blocks along with other features such as wide streets, grand plaza, and monumental civic structures function as tangible indicators of local achievement. It is also a place-marketing strategy, enhancing city image to attract potential investors or business opportunities. There are other practical reasons as well. Developing super-blocks saves the upfront infrastructure costs for the cities, leaving the responsibilities of constructing within-block streets and utilities to future developers.

Perhaps the strongest motivation behind the local officials' favoring super blocks is to secure land before development opportunities mature. Developable land is the major source of local finance. For a period of time (2000-2006), the increase in economic productive land(e.g., industrial land use) was used by the central and provincial government as a proxy indicator of progress in local economic development. It motivated the local officials to establish industrial parks or economic zones. A super-block structure defined by major roads helps maximize land banking under the constraint of limited public resources. The indicator was later abandoned.

Developers prefer super blocks for the interest of scale economy. Large blocks allow them to lower the unit cost of development. Traffic engineers and many planners also support super block concept as they believe traffic moves faster and more efficiently with wider street section and fewer number of intersections associated with super-block-oriented network, although this remains to be verified with empirical data. Furthermore, design work is simpler and hence turn-around time becomes shorter. Residents and workers seem also like super block neighborhoods because super block reduces or entirely cut-off through traffic.

- Do planning codes and standards play a role in producing the new urban form? The answer to this question is both Yes and No. In small cities or less developed regions lacking planning expertise, standards and codes serve as 'planning recipes.' In cases when planners have little time for detailed analyses, copying and pasting from standard modules offer a safe and defensible solution.

In large or developed areas, national standards are too general and outdated. One example is the standard for expressway density. For example, national standards specify a density of expressway at 0.4-0.5 km/sq. km. Rising motorization in large cities however demands much more expressway than the standard. In Wuhan, the planned expressway density increased to 0.7 km/sq.km. Coastal cities mostly surpass the national standards in expressways.

- The interviewees believe that modifying standards and codes at the national level is unlikely to make a difference simply due to disparities among regions in development. Cities like Shanghai and Guangzhou have developed their own planning standards. Shenzhen has started Statutory Planning practice since 1998. It was a response to the increasing lawsuits over land development and control from private business owners. Shenzhen's detailed regulatory plan is made for each 2-4 sq km area in the entire city. Planners should seek public input for 30 days before they submit the plans a planning council for review and approval. The council includes 29 members who review the plan and planners' responses to the public input. Shenzhen-specific planning standards are adopted based on the approved detailed plans. It is an emerging trend that local governments adopt local planning standards and codes to shield themselves from lawsuits.

It is worth noting that, in Shenzhen, a clause is often added to the approved development plan to require a within-super-block road for city access for the purpose of reducing super block effects.

4. Conclusions

Promoting SMT aligns with the goal of developing low-carbon urban communities. SMT links directly with the quality of the built environment. Studies show that SMT is more sensitive to built environment design than motorized travel (Ewing and Cervero 2010 and Zhang 2004). The making of the built environment is tied with planning and design standards and codes, especially in the local, community level. The central government of China has adopted national standards and codes for the purpose of assuring certain levels of quality in community planning, design, and development. In places where there is lack of professional expertise or when the planning/designing work is under time constraint, the standards and codes offer quick and executable solutions. From the viewpoint of the central government, national standards and codes also function as guidance for resource allocation (for example, land) and as means to carry out the national urbanization policies.

Problems arise when the national standards and codes are referred as 'cook book' in a mass-production mode irrespective to local context. The widespread of super-blocks in Chinese cities can be partly attributed to the one-size-fits-all national road standards. Much of existing standards and codes were adopted by the Ministry of Construction (MOC) in mid-1990s or earlier. The knowledge base supporting the standards tends to be obsolete and inadequate to catch up with the rapid changes in social and economic developments especially in large cities and coastal zones. Going local is probably a more sensible solution than maintaining uniformity of national standards and codes.

A fundamental question warranting rethinking is the purpose of planning. Since the 1990s planning in China has turned to facilitate urbanization. This planning focus differs from the profession's tradition of protecting property rights or public welfare. A challenging task for Chinese planners is to refocus plan-making from supporting output-driven growth to enhancing quality of life and to develop sensible planning standards and codes accordingly.

Endnote

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