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Subject: Spatial development of Vietnamese cities

Hanoi urban structure:

Spatial Development Issues and Potential

Date: June 15, 2011

This report is based on interviews, field visits and data collected during a visit to Hanoi with two World Bank missions in June and December 2010.

I. Maintaining mobility and housing affordability should be the main objective in planning Hanoi spatial development

A. Mobility and affordability

The main challenge confronting fast expanding metropolises is improving the mobility of laborers and consumers while insuring that land and housing remain affordable to the majority of households. The two objectives are often difficult to meet simultaneously. Improving mobility requires investments in primary infrastructure that have to be planned and financed in advance, before knowing the principal location(s) where demand for land from varying income groups will be the highest. In addition, the private supply of affordable housing requires a rather laissez faire attitude to land development and housing construction in order to respond to consumer demand for land and housing where it occurs and at a density consistent with constantly evolving market prices.

Infrastructure and land supply

Infrastructure investment is necessary for both mobility and to increase land and housing supply, which in turn insures housing affordability. However, to be useful, infrastructure investments have to be directed to the right place in the right quantity. A high capital investment in infrastructure does not guarantee success if it is invested in the wrong location. Many new satellite towns, located too far from the core city, become a drag on the urban economy and increase transport costs and energy use. The best strategy is for the government to invest in a complete network

of metropolitan, primary infrastructure and to leave the private sector to provide the secondary and tertiary infrastructure. A benign attitude toward low tertiary infrastructure standards in some areas improves the access to well-located housing for low income households, provided these low standard, tertiary infrastructure areas are adjacent to an efficient, primary infrastructure network. This seems to be the investment and planning strategy de facto followed by the government of Hanoi.

Should infrastructure be reactive to market trends or be proactive?

In some cities within the Southeast Asia region, housing supply has increased much ahead of transport infrastructure and has resulted in relatively cheap housing but low mobility (Bangkok and Jakarta, for instance). In other cities (Mumbai and Delhi, for instance), policies restricting both land and housing supply, regulating land development by preventing it from getting too far ahead of infrastructure development, have resulted in very expensing housing, low housing consumption and, often, poor mobility. Beijing also presents an interesting example of failure to anticipate a shift in dominant transport mode, from bicycle to cars; the result is severe congestion, drastically reducing the mobility of the labor force (see Annex 3).

The balance between infrastructure development and land supply can be achieved through careful monitoring of spatial demand for land and floor space within a metropolitan area. Monitoring and interpreting the spatial trends, as indicated by land markets and rents for various income groups, is the best way to guide infrastructure and transport investment to the locations where there is the most demand. Detecting spatial trends and anticipating the location of demand for land and housing is the approach I have tried to follow in this report.

The development of Hanoi's road infrastructure has maintained a satisfactory land supply over the last 10 years

Urban development in Hanoi over the last 10 years has had a very positive record. Household incomes have increased by 6.2% per year in real term. The average household's floor space consumption has increased from 10.5m2 per capita in 1999 to 21 m2 in 2009[1]. The average commuting time is approximately 19 minutes, which is very low for a city of 3 million people

Perhaps most remarkably, though, is that Hanoi has not only been able to absorb a large number of migrants during the last 10 years- with an average urban population growth rate reaching 3.35% a year between 2000 and 2010, but contrary to many other East Asian cities facing rapid urbanization, Hanoi has been

[1] 1999 Statistical year book; 2005: HAIDEP HIS 2005

able to do so without the formation of large slum areas. So far, the housing supply has been quite elastic in its response to the increase in demand from various income groups. This is due in large part to the pragmatic attitude of the government which has legalized the densification of former village areas while actively promoting the development of a modern primary road network in the immediate periphery; they have carefully avoided demolishing the older housing stock, except when necessary for road widening. This new, primary infrastructure network has not only opened new land for formal developers, but it has also allowed the existing rural settlements better access, densification, and integration into the urban economy. This important topic is further developed in a section below.

However, as urban household incomes increase further and the country continues to urbanize, demand for land, floor space, transport and infrastructure is bound to increase at an even faster pace during the next 10 years. The main challenge facing the government will be to respond to a rapid increase in demand for developed land and for new urban transport infrastructure. These demands will be compounded by a simultaneous increase in the size of the urban population, a decrease in household size and a rise in floor space consumption per capita due to rapid growth in household incomes and business investments.

B. Mobility: The choice of a transport strategy should be linked to land use trends

The government will have to select an urban transport strategy consistent with the spatial development trends of the city. So far, motorcycle transport, representing 81% of all trips in 2008, has been the dominant mode of transport in Hanoi. The motorcycle has been an efficient means of transport for the initial economic take-off phase of the city. It has allowed an increase in worker and consumer mobility and good accessibility to many suburban areas with relatively little investment in major arterial roads and secondary and tertiary infrastructure. The motorcycle has been able to provide access to jobs from traditional residential areas without an adequate vehicular road network. The use of cars (4% of trips) and of public transport (11%) is still very low (*table 1*).

Hanoi Transport modal split (2008)

	Modal Split
Buses	10.7%
Tourist buses	1.8%
Cars and mini vans	4.0%
Motorbikes	80.8%
Bicycles	2.5%
Light trucks	0.2%

source: http://tramoc.com.vn/file_download/1235358776_305.pdf

Table 1: transport mode splits in Hanoi

Hanoi's current densities and street patterns are incompatible with the use of car as a main mean of urban transport

As cars become more affordable and as household incomes increase, many of the households and firms currently using motorcycles as their main means of transport are very likely to shift to individual cars or trucks. Even if the average population density of Hanoi decreases slowly, as has happened in other major metropolises of the world, current density is high (188 p/ha average density in built-up area in 2009[2]) and is likely to remain high in the future. This high density is not exceptional for an Asian city (*Figure 1*).

A shift in the dominant mode of transport from motorcycles to cars threatens to decrease mobility as the space required for car circulation may prove to be incompatible with the current area of streets and the spatial structure of the city. Jakarta and Bangkok, for example, as a result of their underdeveloped primary roads and transit systems, experience extremely high traffic congestion even thought their densities are lower than that of Hanoi.

[2] Author's calculation based on 2009 population data by district and wards and built-up area vectorized from 2008 Google Earth imagery.

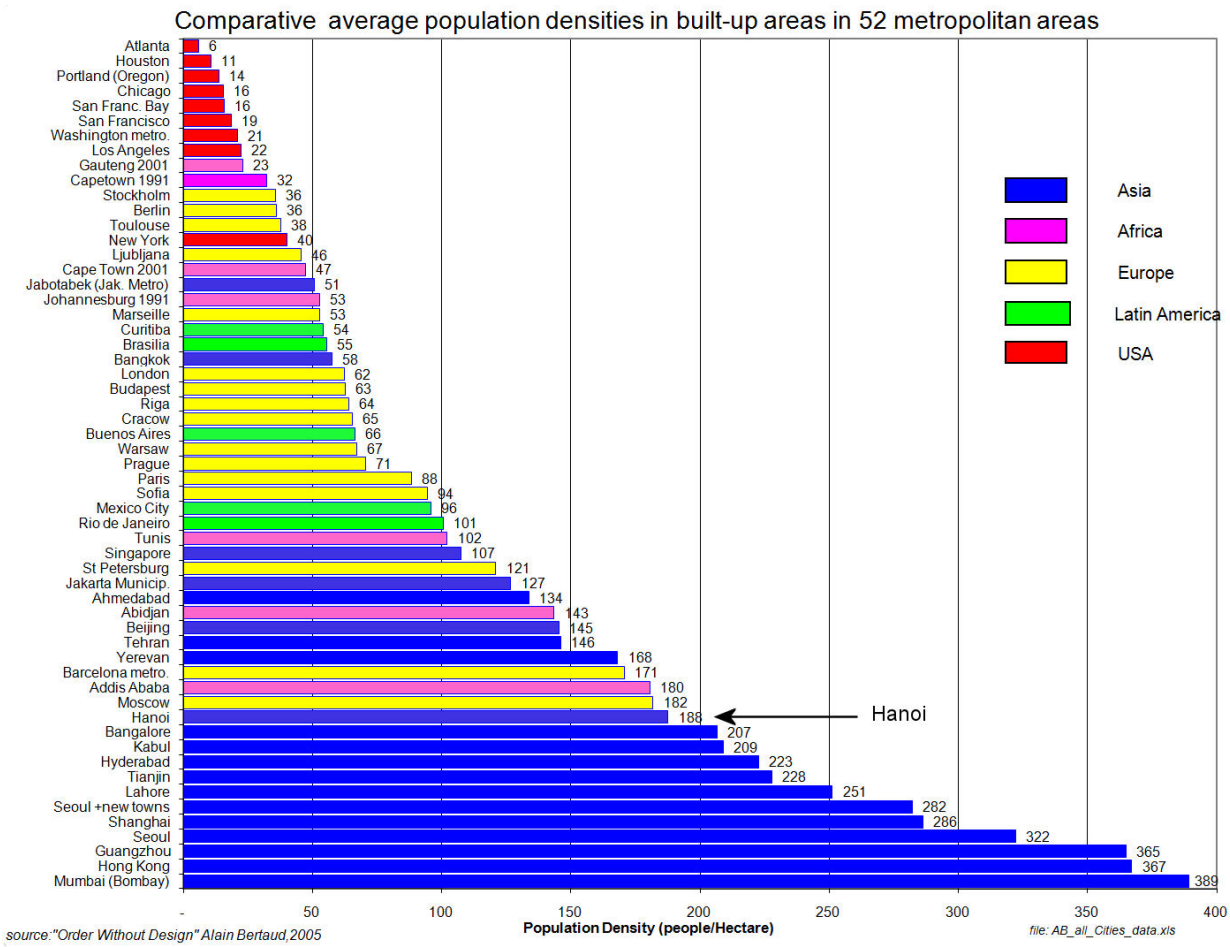


Figure 1: Comparative built-up densities in 52 metropolis

The current road space area in Hanoi is small. In many neighborhoods, road space represents no more than about 20% of total built-up area; given the average built up density of Hanoi, this translate into a road area of 11m2 per person. Cars use an incompressible amount of road space for both on road parking and circulation (14m2 for a car parked on street and 65m2 for a car running at 30 km/h). The percentage of land devoted to road space in the existing built- up area is practically fixed, and it is difficult to increase it on a large scale to accommodate even a moderate increase in car traffic without major demolition and relocation, both costly.

Figure 2 shows the relationship between densities and street area per person in a number of neighborhoods, in a select number of large metropolises. The densities and street space of three neighborhoods located in southwest Hanoi are also shown for comparison. Horizontal lines on the graph represent the street space required by a motorcycle (1.8 m2) or a car (14 m2) when each is parked on street and the road space required for a car moving at 15k/h (40 m2) and at 30 km/h (65 m2). The blue diagonal street crossing the graph represents the number of

square meter of street per person when the percentage of street space is 25% of the total area and the density increases. The negatively slopping line shows that the adequacy of street space for car circulation is not only related to the percentage of road space but to the combination of road space and density. A road space of 25%, which is quite adequate for car traffic at a density of 30 people per hectare, is quite inadequate at densities above 100 people per hectare. As urban planners cannot easily change the percentage of roads and densities, it is clear that it is the mode of transport that has to adapt to the city structure and not the opposite.

Even a small shift from motorcycle to car trips could paralyze mobility in many neighborhoods of Hanoi.

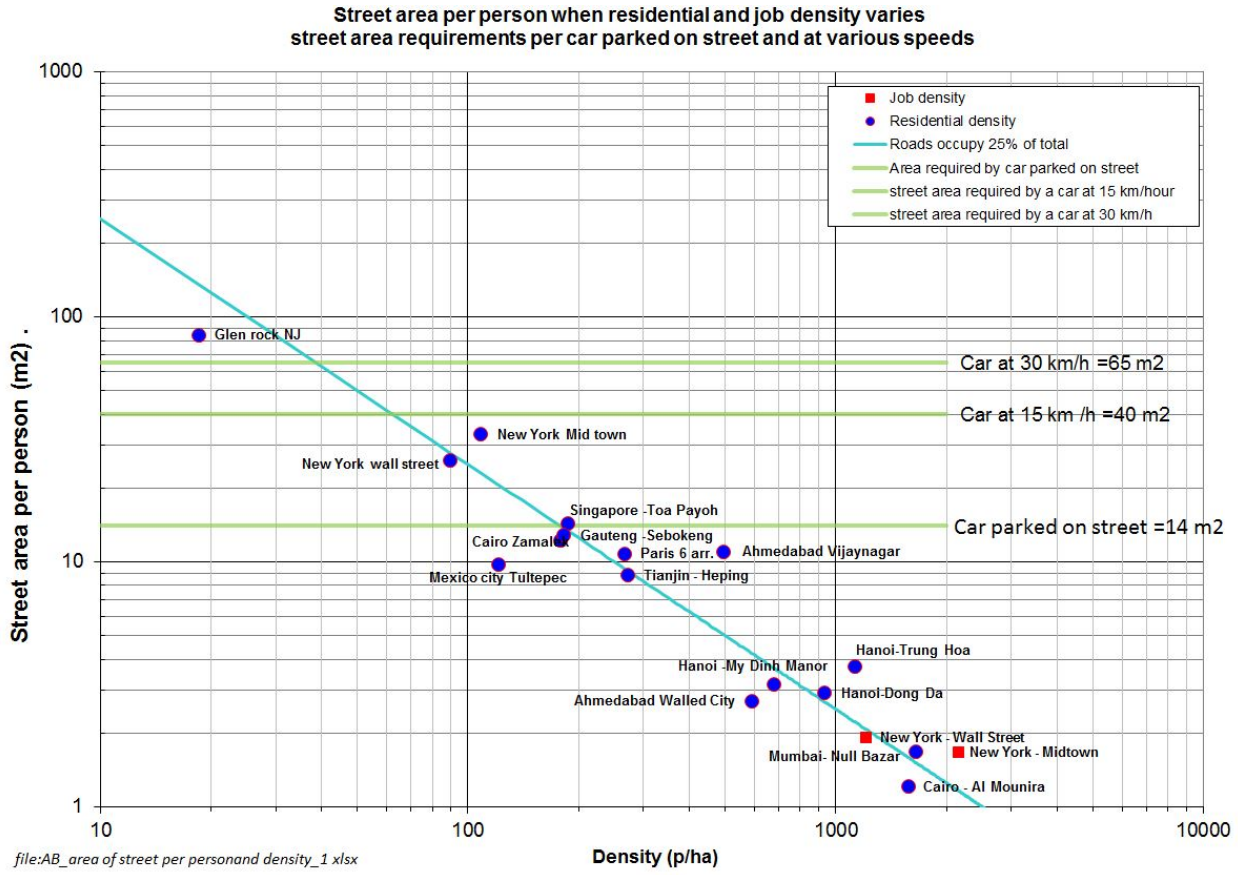


Figure 2: Street area per person and densities in selected urban neighborhood in the world.

It is, of course, possible to increase the road area of a city by widening existing roads or by opening new roads across existing neighborhoods. This policy has been followed in a number of cities in China, for instance. While at times it may be necessary to create new roads through dense neighborhoods, the financial and social costs and the time required to demolish and to relocate houses and business in dense neighborhoods can be prohibitive. In Hanoi, the example of Xa Dan road, which created a 40 m right of way through a very dense neighborhood,

has been a useful step to increase local accessibility and to reduce local traffic jams, but it didn't significantly increased the amount of total road space in the city. While strategic operations like the widening of Xa Dan road will have to be conducted in some other parts of the city, they will be limited because of the high cost of relocation in high-density neighborhoods. These street widening operations, while locally useful to alleviate traffic congestion, will remain exceptional and will not increase the total road area sufficiently such that cars could become a dominant and viable mode of transport in Hanoi in the future.

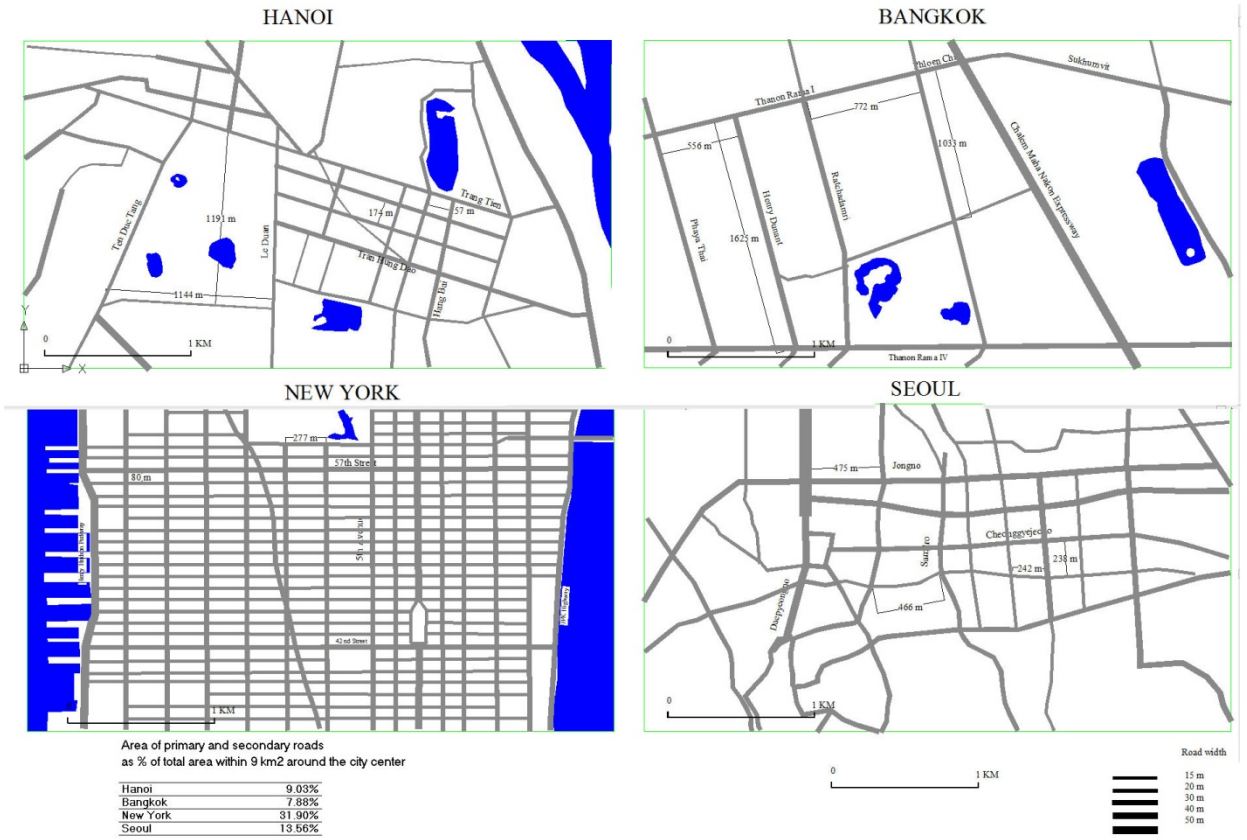


Figure 3: Comparison between major road network in Hanoi, Bangkok, Seoul and New York

The maps in *Figure 3*, all at the same scale, show the pattern of streets larger than 15 meters in the CBDs of Hanoi, Bangkok, New York and Seoul. These maps clearly illustrate that the pattern of major streets in Hanoi (9% of total area) is somewhat more dense that in Bangkok (7.8%) but quite lower than in Seoul (13.6%) and in Midtown Manhattan (31.9%). In addition, both Seoul and New York have extensive, underground transit networks that alleviate the need for surface transportation.[3]

[3] The map of Hanoi's built-up densities, shown in Figure 4, is based on land use and demographic data within the 12 central districts . The built up area has been identified by using a land use map, prepared by the master plan department, and by complementing it by vectorizing 2008 Google Earth images of Hanoi. The demographic

Hanoi's current road network *(Figure 3)* and its high built-up densities, shown on *Figure 4*, will be incompatible with the demand for road space created by a shift to individual cars for even a small fraction of the trips currently using motorcycles. For instance, at the current average Hanoi density (188 p/ha), a car ownership of 250/1000 (similar to the average of Malaysia but much less than Kuala Lumpur) would require a vehicular street area occupying 19% of the total built up area – practically the entire current street right of way – just to allow half of the cars owned to run at 30 km/h. As the centrally located districts have densities close to 400 p/ha, a car ownership of 250/1000 would guarantee a total gridlock in the central part of Hanoi (*Figure 4*)

To maintain mobility and to increase land supply in the future, the government does not have much choice for its transport strategy. We can conceive of a strategy that should involve 2 phases:

1) Maintain motorcycle use as the main mode of transport by preventing increased car use through draconian pricing measures, similar to the ones used in Singapore, while developing a road system to increase the speed and safety of motorcycle trips, and
2) Develop, over the years, a road and transit system that is compatible with the current high densities and the land use trends reflected by consumer demand for housing and commercial facilities. Land use policy and land use regulations should also be adjusted to be consistent with consumer preferences, reflected by housing and business space affordability.

data comes from the census, updated up to 2009

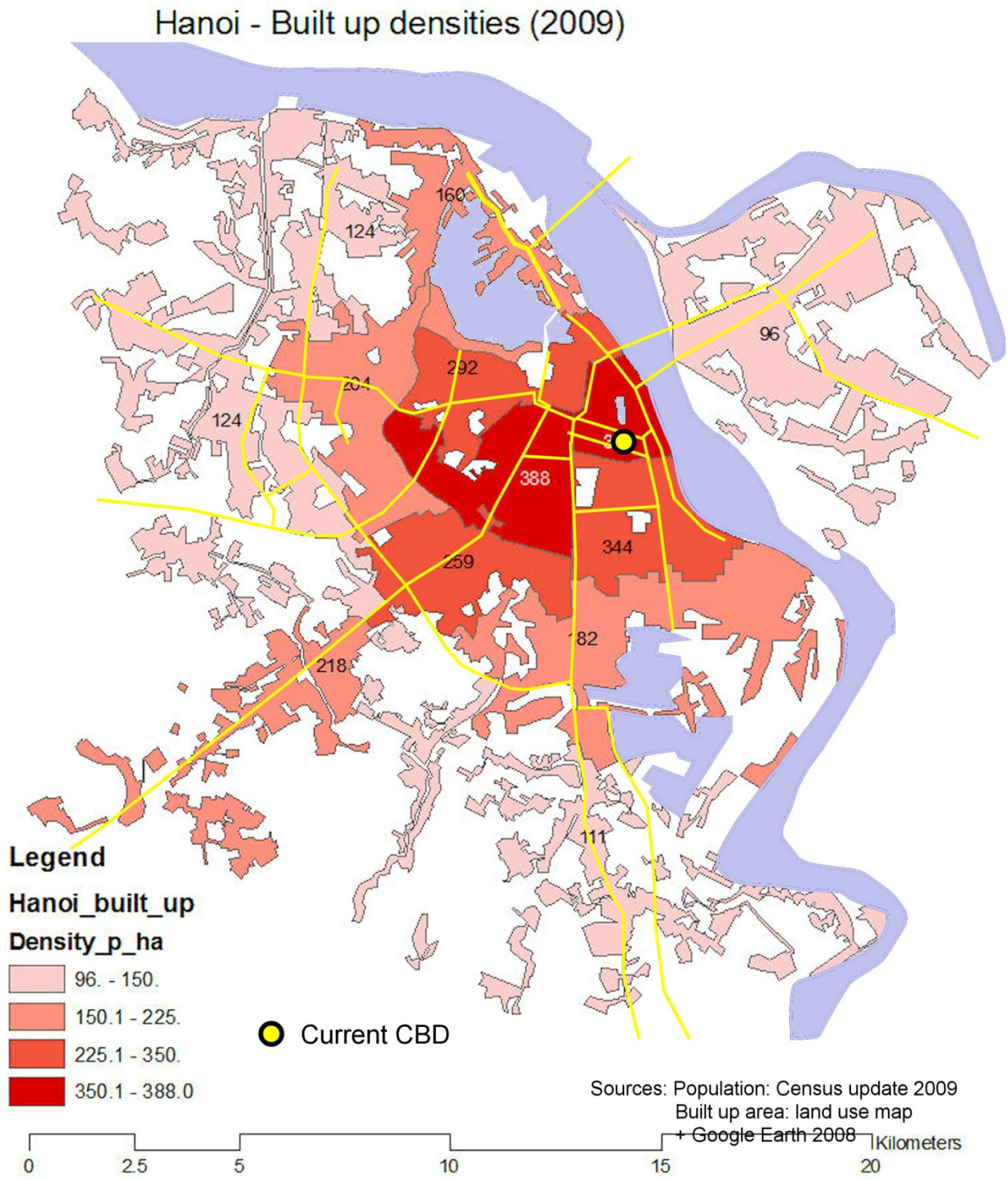


Figure 4: map of Hanoi built-up densities (2009)

It seems that the government is already planning the second phase, or at least a part of it, as several transit system projects are already under study or under implementation. The transit projects currently planned include improved bus services, BRT, underground or aerial metro and suburban heavy rail. However, it

is not clear at this moment that the transit strategy and design take into consideration what the city spatial structure is likely to be at the time when the transit network will be fully operational, in at least 10 to 15 years from now.

Transit usefulness depends on the ratio between the population and jobs within the catchment area of the network and the total population and job numbers. When this ratio is below 50%, the share of transit trips over other modes is likely to be small. During the period when a transit network is under development, the network is bound to be short and to have a limited spatial coverage. In the initial stage of development, a transit network's usefulness as a mean of transport is, therefore, limited and is unlikely to relieve much congestion. It is only when the network is able to efficiently connect more than 50% of residences and jobs that transit is likely to become an important mode of metropolitan transport.

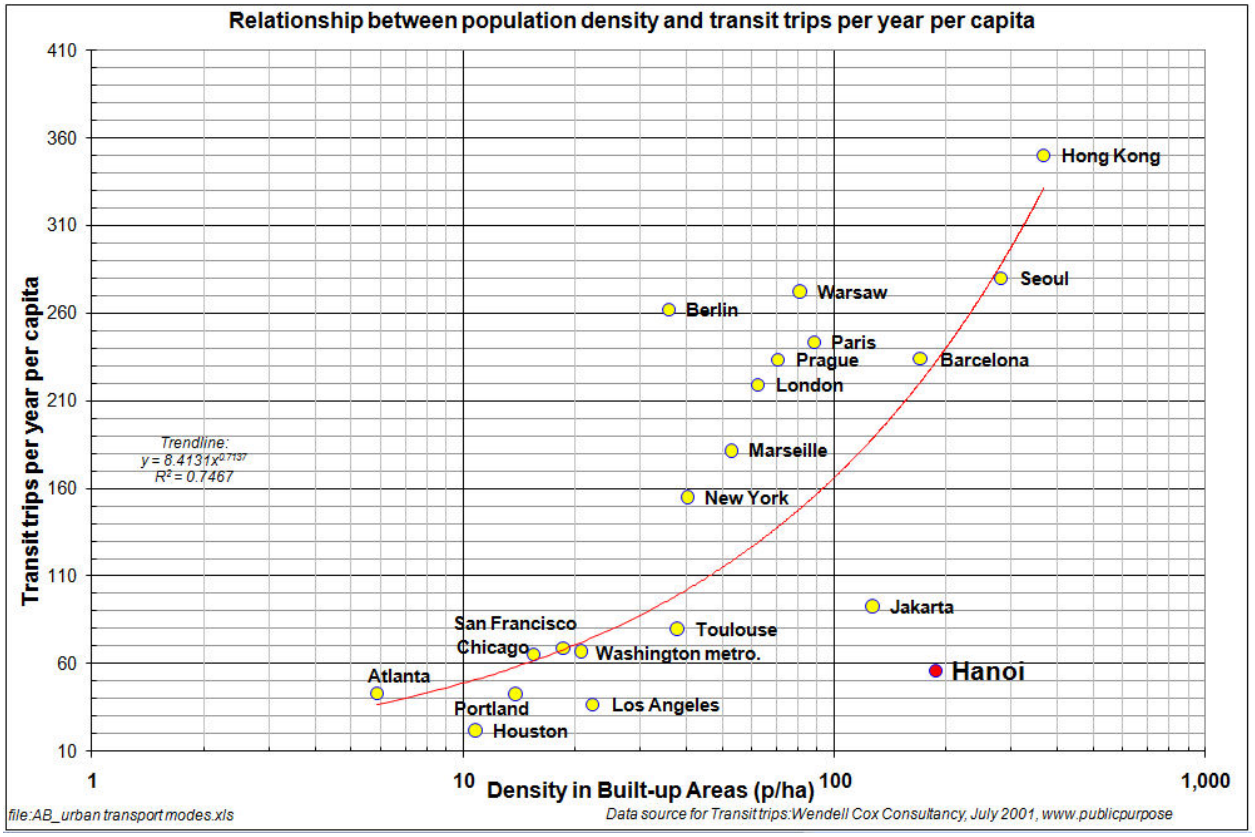


Figure 5: Correlation between density and transit use

The various transit networks currently planned in Hanoi are, therefore, unlikely to start having an impact on mobility and congestion before the year 2025. Meanwhile, the city will have to maintain mobility and avoid the fate of Bangkok and Jakarta- where transit is only now catching up with urbanization. While

accelerating decisions and investments concerning the development of transit, Hanoi local government should also focus on how to maintain mobility during the 15 year transition period until the transit network becomes available and viable. Managing an increase in car traffic, in particular through parking pricing and cars user fees, should be a priority if the city is to maintain its labor mobility on which its productivity depends. At the same time, roads should be made safer for motorcycle traffic in order to remove some of the pressure on motorcycle users to switch to cars. Traffic lanes could also be specifically redesigned to manage motorcycle traffic.

As illustrated in *Figure 5*, there is a clear correlation between density and transit use among the major cities of the world. Hanoi is an outlier among the cities shown on the graph; the number of transit trips in Hanoi is only a fraction of the number of trips in cities with similar or even lower densities. Jakarta is the only city among those shown on the graph that has a relatively low transit share in relation with its density. However, severe traffic congestion in this city is greatly affecting its productivity. The high mobility currently enjoyed in Hanoi (19 minutes mean transit time) is exceptional in the absence of a large transit mode share. This exceptionality is entirely due to the use of motorcycles. Preserving this use until an efficient and extensive rapid transit network has been built should be one of the main objectives of the government.

The land use policy that would allow the development of transit in Hanoi in the long run is one of the main focuses of this report's recommendations. The other main topic of this report is land and housing affordability.

Hanoi land use shaped by the easy accessibility provided by the dominant use of the motorcycle will be nearly impossible to reverse

There is no evidence from the experience of other cities that just building new transit lines creates a shift in demand toward transit away from individual vehicles like motorcycles and cars. This is especially true when the use of individual means of motorized transport have been prevalent over many years, as is the case in Hanoi. The prevalent transport mode, whether it is motorcycle, car or transit, greatly affects land markets, and therefore, location decisions. As such, it can be anticipated that location decisions over the next 15 years will be dictated by ease of motorcycle access, and increasingly, by ease of car access. Only after 15 years, when transit has become an efficient means of transportation, may the land market shift such that high prices, and therefore demand, are found in areas around transit nodes.

To be successful in competing with individual means of transport, transit companies have to offer shorter and/or cheaper trips. These trips have to have their

origin at the location of residence and their destination in areas where jobs and commerce are concentrated. Empirical evidence shows that transit can compete with individual modes of transport only in cities where (1) residential densities are above 40 p/ha, and (2) trip destinations are heavily concentrated in a few locations (for instance, where job concentrations are similar to those found in Midtown Manhattan, Jongno Sam Ga in Seoul, the Golden Triangle in Jakarta, the CBD of Singapore, Tverskaya in Moscow, etc).

The first condition on minimum density is easily met in most of Hanoi's neighborhoods; densities too low to allow transit to operate efficiently will not be an issue even in distant suburbs of Hanoi (*Figure 4*). Although there is a high concentration of retail, cultural amenities and government buildings around the traditional CBD, jobs in Hanoi are not heavily concentrated. No direct data is available on job location and densities, but the pattern of residential densities and a visual survey of land use show that areas of retail, office buildings, and small manufacturing are heavily dispersed throughout the metropolitan area.

This dispersion has been made possible by the dominant use of the motorcycle. The shape of cities is path dependent. This means that Hanoi land use was largely influenced by the easy accessibility provided by the quasi-universal use of the motorcycle and that it will be nearly impossible to reverse. The 11% of the trips that currently use buses do not have enough impact to influence land use. Under the current transport mode split, businesses do not have to concentrate around bus lines to have access to employees and customers. It is enough to locate in places that have good access by motorcycles.

Motorcycles and cars provide better access to areas where development is more dispersed, where streets are wider and where parking is easily available. As a consequence we could expect that the current use of the motorcycle will tend to disperse jobs in suburban areas where new wide streets are being built, and away from the central areas which are constrained by the existing limited space devoted to streets and parking. The main issue to be addressed, therefore, is to anticipate where these new job locations are likely to appear and to try to concentrate them in sub-centers that could later be easily linkable by transit. The design of main roads in these areas should also take into account the introduction at a later stage of BRT or other forms of transit. The easy circulation of pedestrians within and between the new sub-centers should also be planned.

Could the current CBD increase its share of total metropolitan jobs?

It is possible to increase the concentration of jobs in already existing CBDs – as has been done in New York and in Singapore, for instance – by increasing the floor area ratio and by building skyscrapers for both office buildings and housing.

However, this solution does not seem to be relevant to Hanoi's current CBD for 3 reasons. First, the historical CBD contains many historical buildings and parks that should not be destroyed but preserved. Second, as previously demonstrated, the road access to Hanoi's CBD is not sufficient to support a higher concentration of jobs and residences (see *Figure 3)*, and the current road network would be difficult to expand because of the need to preserve its cultural heritage. Third, the location of the CBD is eccentric compared to the new center of gravity of the population (*Figure 4*), and this eccentricity is bound to increase as the city develops further away from the Red River and toward the southwest.

The current spatial trend shows a shift of the center of gravity of the city toward the southwest

The creation of an alternative, modern CBD close to the population's shifting center of gravity is to be expected in cities that are located next to a wide body of water. Jakarta's Golden Triangle, for example, has spontaneously developed 9 km to the south of the old, traditional CBD, which is located on the water, close to a port. The same situation is happening in Hanoi where the Red River constitutes a barrier to development toward the northeast. For centuries, the Red River was the main transport access for the CBD to the rest of the country and the world. However, because there are few bridges across the Red River and because the river is very wide[4], the Long Bien district has the lowest density (96 p/ha) among the 12 urban districts in spite of being less than 2 km, as the crow flies, from the current CBD(*Figure 6*). The low density reflects a low demand.

Dong Da, the district immediately to the southwest of the current CBD has the highest density in the city (388 p/ha). The demand for land and the most recent government investments in primary roads point to an extension toward the southwest as shown on the map of *Figure 6*. There is no reason to contradict this demand driven trend, which is reinforced by ongoing government investments in infrastructure. The anticipated shift in density and job location should be taken into account when developing a mass transit policy. The spatial study of land prices and rent being conducted now, as part of World Bank urban review, should confirm this shift.

Right now, most of the new, prestigious and denser commercial, office and housing developments are being built in the southwest of the city along the axis of Pham Hung Road in the Cau Giay, Tu Liem and Thanh Xuan districts. The new mixed-use, high-density developments are dispersed along an axis about 8 km long and 3 km wide, located about 8km to the southwest of the current CBD (*Figure 6*).

[4] The Red River is 936 meter wide at the Chuong Duong Bridge, compared to 425m for the Wang Po in Shanghai, 239 m for the Thames in London and 113m for the Moscowa River in Moscow.

A new CBD is progressively developing as new construction on both sides of Pham Hung Road (*Figure 7*) provides modern office buildings- a scarcity in the current CBD. This new business center will be easily accessible from the densest part of the older city. Its network of modern, wider roads is designed for handling a larger volume of traffic and is more adapted to a mix of motorcycle and car traffic. In addition, it will have a direct highway connection to the international airport and its industrial zone. The government anticipated demand for land in this area by investing in primary infrastructure, thus, making it a more accessible area of the city and contributing to the shift of the center of gravity of the population.

The New Urban Zones: a move toward a polycentric city

New Urban Zones (NUZ) are discrete land development projects, usually directly connected to a major primary road and the majority of which include mixed land use: office buildings, retail, commercial centers, residential towers and town houses. They range in area from 5 to 60 hectares. The combination of high-rise towers and townhouses of up to 5 floors allows high floor area ratios and high densities ranging from 500 p/ha to 1200 p/ha. These are higher densities than the densities found in the current CBD (the highest density in the CBD is 800 p/ha in Hang Kai ward in the Hoan Kiem district). The NUZ are often adjacent to traditional residential neighborhoods that will then benefit from the proximity of primary roads, commerce and new employment areas. There might also be a commercial spill-over from the NUZ to the adjacent traditional neighborhoods. As a result, the residential densities of the traditional neighborhoods are likely to increase further. The traditional type of townhouse or “tube house” is easy to expand vertically and therefore constitutes a part of the housing stock which can show a high supply elasticity to price increase.

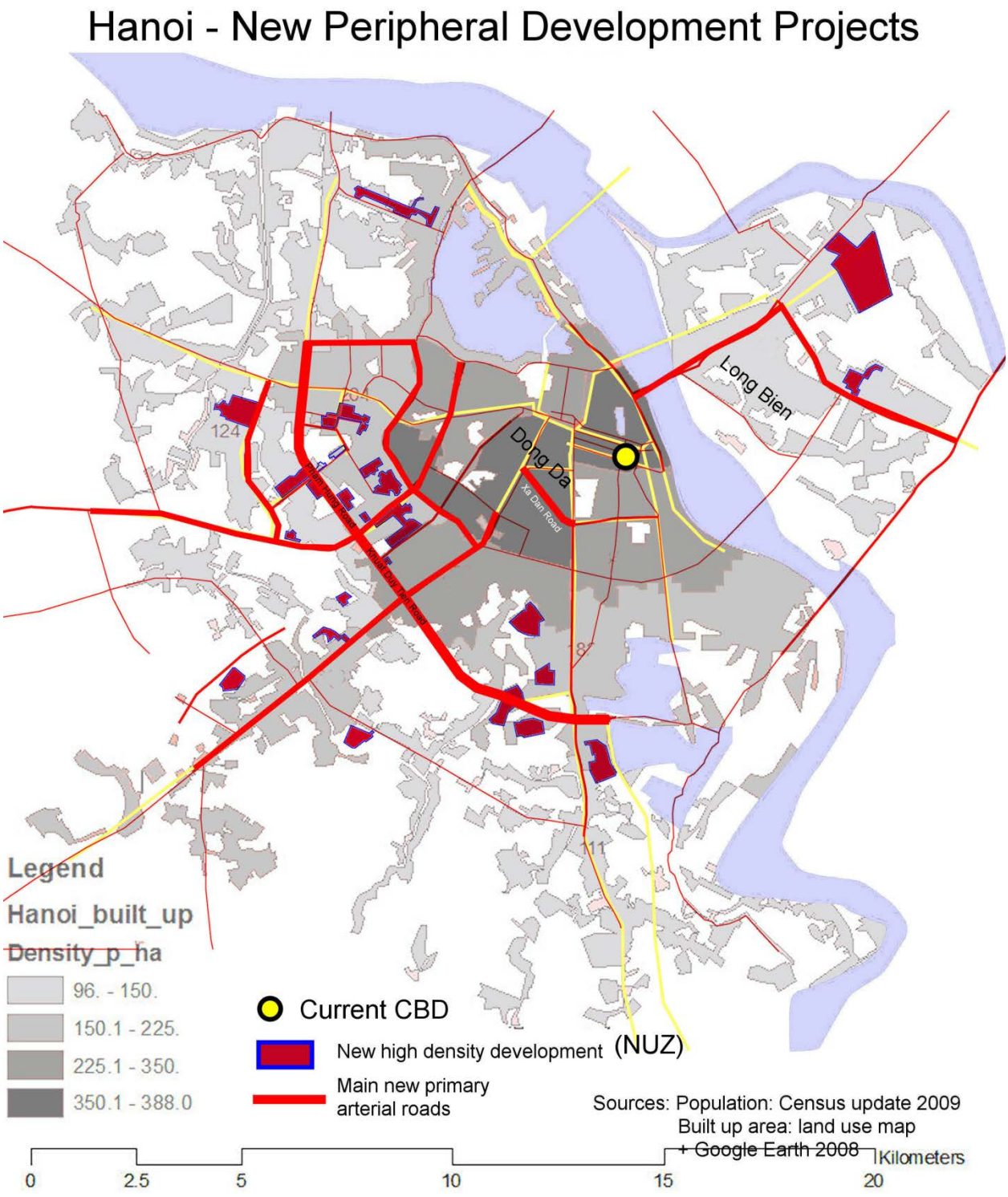


Figure 6: New Urban Zones in the South West of Hanoi

This pattern of new urban development- formal, high-end development occurring next to former villages that are allowed to densify, will prove very favorable for preventing future income segregation.

Sample of land use characteristics in various neighborhoods of Hanoi

Settlement name	Type of development	Distance from CBD (km)	% streets	%open space	Gross FAR	Net FAR	Estimated density (p/ha)
My Dinh -The Manor	High Income- commercial	8.0	21%	52%	2.26	2.88	679
Trung Hoa	Medium income - Town houses, villas and towers	5.5	42%	7%	2.62	5.24	1,120
Nam Trung Yen	Medium low income town houses + towers						
Trung Yen	Medium low income town houses						
Dong Da district Ward Nga Tu so	town houses - informal planning	3.4	27%	1%	1.74	2.5	929
Hoan Kiem District Hang Kai ward	Mix commercial residential -old city	0.5					807
Hanoi CBD (Hai Ba Trung) [1]	Commercial buildings some housing	-					171

[1] 5 wards of Hoan Kiem district : Cua Nam, Tran Hung Dao, Hang Bai, Trang Tiem and Phan Su Trinh
Source: Census updated to 2009, Google earth image, author calculations

Table 2: Land use in few selected New Urban Zones and traditional neighborhoods *(to be completed)*

Figure 7: new development along Pham Hung Road

Figure 8: high density suburbs being built at about 10 km from the current city center

The type of low cost development taking place in Hanoi's suburbs, as shown in *Figure 8*, built side by side with the planned, modern infrastructure of the New Urban Zones, shown in *Figure 7*, confirms that Hanoi's land market is slowly reshaping this city into a dense polycentric city. The development of the primary road network and the planned transit system should take this structural shift into account.

The probable shift of the spatial structure of Hanoi from monocentric to polycentric is also suggested by its current density profile as shown on *Figure 9*.

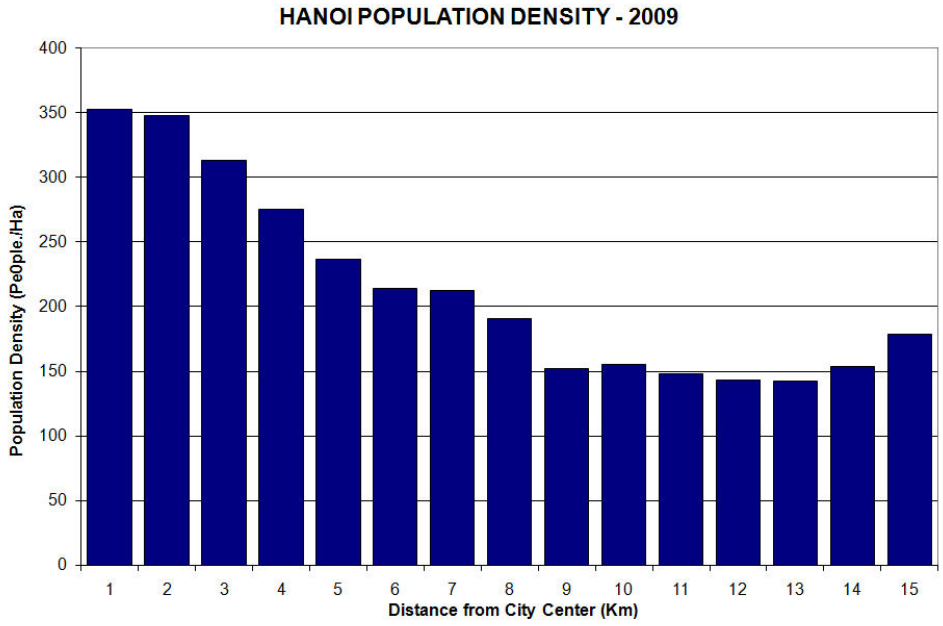


Figure 9: density profile of Hanoi

The density profile of Hanoi, with densities at 6 and 7 km from the CBD that are nearly 60% of the densities at the center, is relatively flat. When the new urban zones in the southwest are complete and fully occupied, the density profile will be even flatter. A density profile with a flat gradient would be typical of dense polycentric cities like Seoul. If one compares the density profile of Hanoi to the density profile of 5 other cities (*Figure 10*) (Seoul, Bangkok, Beijing, Jakarta and Barcelona[5]), the profile of Hanoi is somewhere between Seoul and Bangkok. However, its dense suburbs and the high-density, mixed-use developments currently being built in the suburbs, suggest that within a few years Hanoi's profile would be closer to Seoul's than to Bangkok's or to other East Asian cities.

[5] Barcelona was added – in spite of not being an Asian city – because it has about the same population as Hanoi and with 171 p/ha a similar average density with Hanoi 188 p/ha

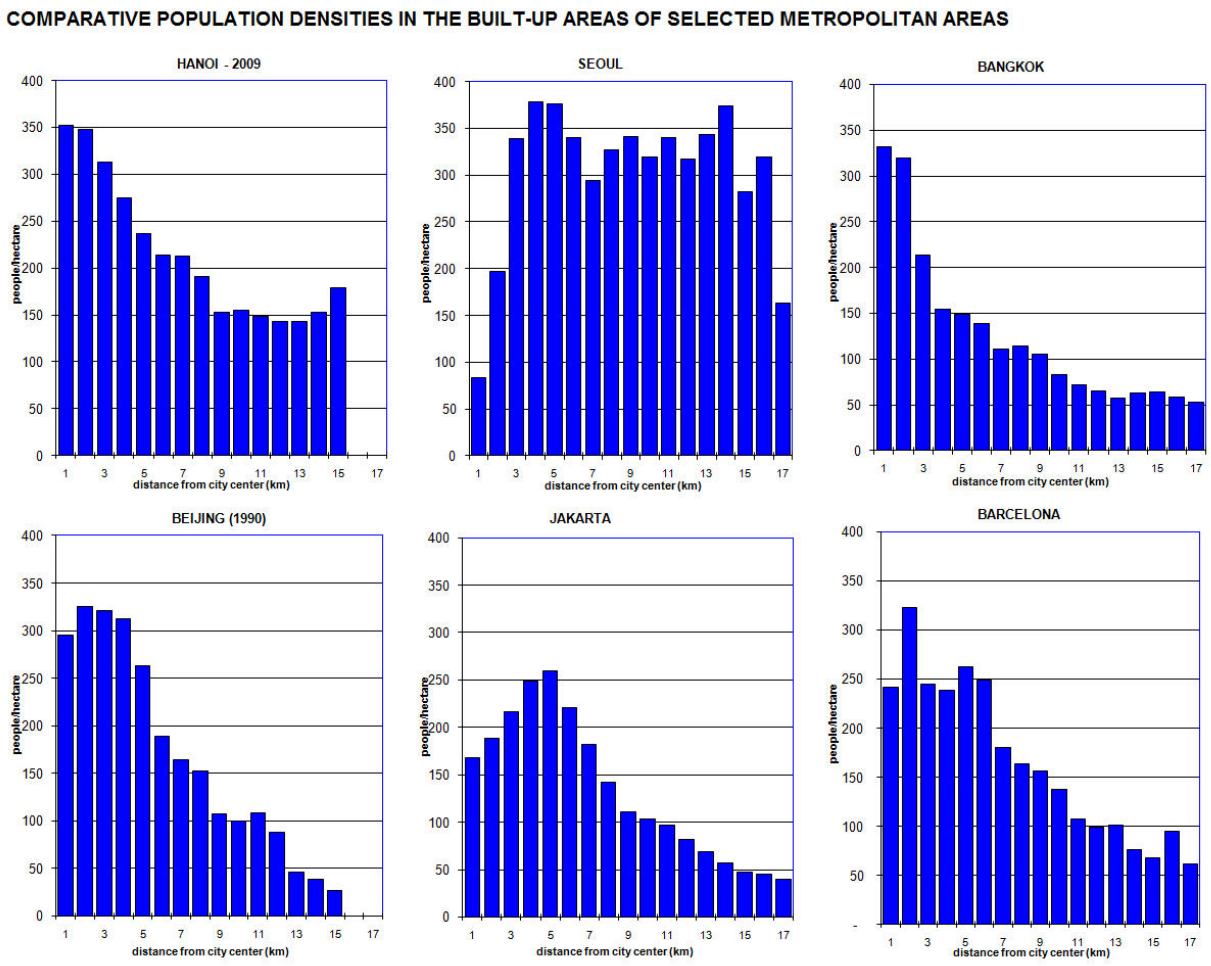


Figure 10: Hanoi density profile compared to 6 other cities

For transport, dense polycentric cities have advantages and drawbacks compared to monocentric cities with dense centers and low-density suburbs. An advantage is that they are more compact, and therefore, transport distances are shorter. A drawback is that they are uniformly dense, and therefore, most transit lines are costlier and often have to be built either below or above grade. A high-density, polycentric spatial structure implies low land consumption and therefore a small footprint, high floor area ratios, and a transit and road network that is grid-like rather than radial (see *Figure 11*). If Hanoi is to make this transition, land use regulations and infrastructure will have to be adapted to this evolving spatial structure.

The development of a transit network should anticipate structural changes in Hanoi spatial development

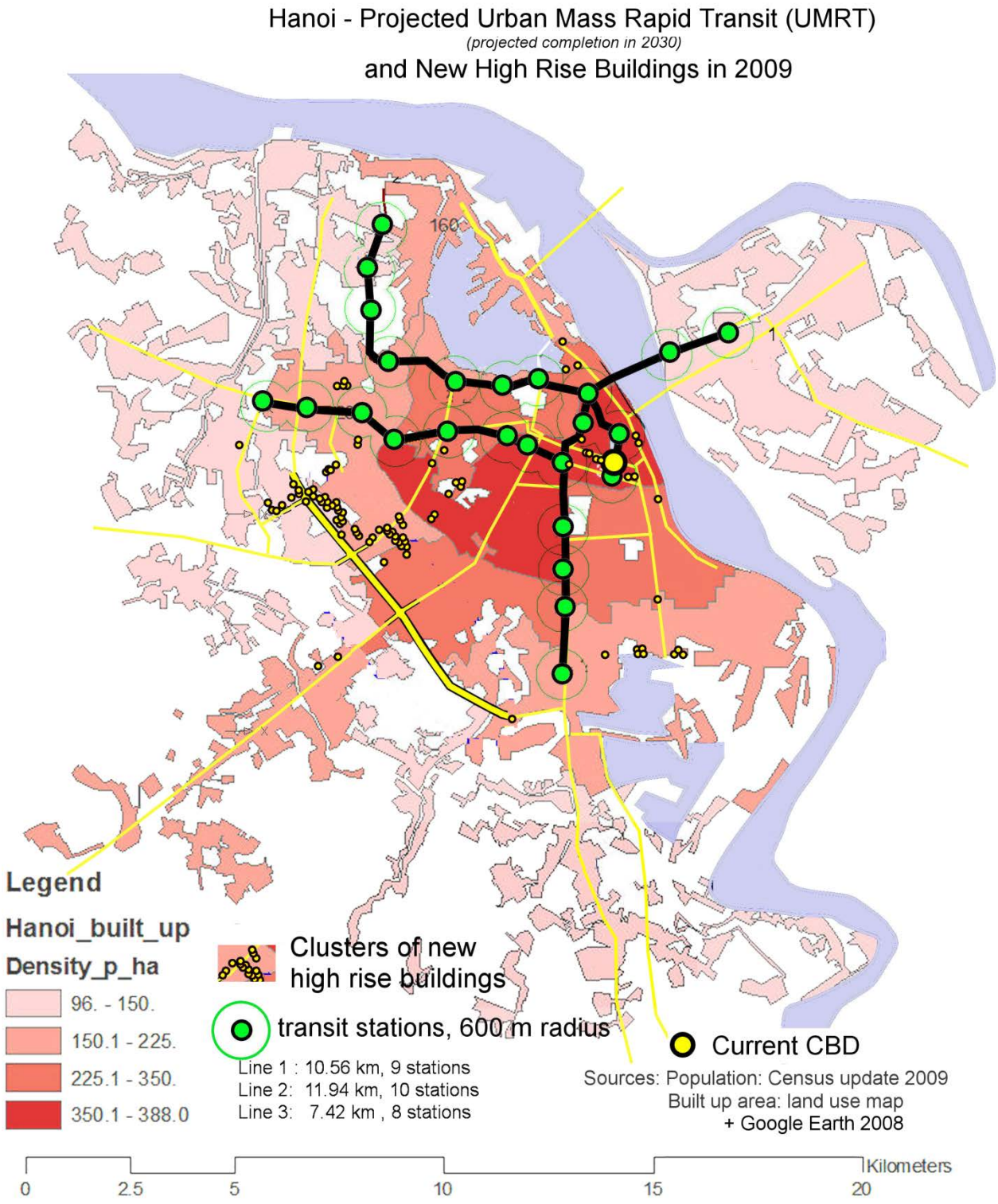


Figure 11: Projected mass transit network and development trend shown by high rise buildings

Growth in the demand for mass transit in cities where individual means of

transport dominate is necessarily slow even when land use and the city structure are favorable to transit. In Hanoi, the projected transit networks will provide a privileged accessibility to a few areas of the city where the various transit lines will meet. In most large cities with an extensive transit network (New York, London, Paris, Singapore) trips from the periphery to the dense CBD are done mostly by transit while trips from suburb to suburb are conducted predominantly by individual cars.

The first phase of Hanoi's urban mass rapid transit (UMRT), which includes 25 stations and the connecting network, is planned for completion by 2030 and is designed to serve the current CBD. (*Figure* 11). The catchment areas (600 m radius) of the projected stations will represent an area of 26 km2. About 660,000 people living within these catchment areas will be able to access the UMRT network (see *Annex 1*). Therefore, in 2009, the population able to walk to a projected UMRT station represented about 22% of the 3 million people currently residing in the 12 urban districts. However, between 2010 and 2030, the majority of new development is projected to take place outside of the UMRT catchment area. Consequently, in 2030, the number of people living within the catchment area will represent a much smaller percentage – probably not more than 12% – of the total population of Metropolitan Hanoi, which is projected at 6.6 million in 2030 when the network is scheduled to be completed.

The current projected network is consistent with a monocentric city with a concentration of jobs around the current CBD (shown on map of *figure 11* as a yellow dot). However, the trend in development and future densities of both jobs and population can be anticipated by the recent construction of towers of more than 10 floors (shown on the map of *figure 11* as small, yellow dots). These high-rise buildings are either commercial or residential, and therefore, they will increase both the population and the job density of the areas in which they are built.

As we can see from the distribution of high-rise buildings shown on Figure 11, the new developments and the higher densities already being built and planned in the southwest area of the city will not be served by the first phase of the transit network. By the time the system is completed, it is likely that a majority of the service jobs and the highest densities will be found along the Pham Hung Road in southwest Hanoi. The high land prices along the Pham Hung road axis will result in higher residential and job densities in adjacent areas currently occupied by traditional town houses. These areas should be served by transit in the future if transit is to ever represent a major mode of transport in Hanoi.

The UMRT is not the only mass transit system being planned. It is important that the complete transit network projected for Hanoi reflect the emerging

polycentric structure of the city. Given the anticipated spatial structure of Hanoi, it seems that a grid-like network would have a better chance of attracting passengers than would a network like the UMRT that is radial and centered on the traditional CBD. The grid-like network of the mass transit system in Seoul, for instance, would be a better model than the radial system of Singapore- which is a good fit because of the very heavy concentration of jobs in the CBD and its high floor area ratio (*Figure 12*).

Hanoi's alternative transit strategies: Seoul or Singapore?

The two mass transit systems of Singapore and Seoul are useful examples of two very different designs, each well adapted to its specific land use. Both transit systems rely on a combination of buses and metro. Hanoi will have to make a choice now between these two very different strategies.

In Singapore, metro lines are converging toward the dense CBD, which is being expended through land reclamation and higher floor area ratio (the highest FAR in Singapore's CBD extension reaches 25, as compared to 15 in Manhattan). Urban highways are also designed to provide excellent car and freight access to the CBD. The fluidity of car traffic is maintained by congestion pricing. The transit system is based on few metro lines and a system of feeder buses and light(rail?) trains that converge on transport hubs along the metro lines. The system requires usually one transfer from bus to metro. The average door to door commuting time in Singapore for transit users (metro and buses or both) was 47 minutes in 2008. For car users, the door-to-door average trip time was 25 minutes. Singapore manages to maintain a high transit ridership in spite of the much shorter motorized trip time by charging a high fee for car purchase and by charging congestion prices for entering the CBD. The average peak hour traffic speed on urban roads is maintained at 27 km/h and at 62 km/h on expressways.

While the Singapore transit model is often praised for its energetic control of car traffic through congestion pricing, it would not be well adapted to the Hanoi context for two reasons. First, a network with a few metro lines fed by buses is well adapted to an area with a high concentration of jobs in the CBD, but it does not provide competitive transport solutions for trips from suburb to suburb, which are the most common type in a polycentric city like Hanoi. The efficiency of the bus feeder services in Singapore relies on an extensive suburban network of expressways that would be impossible to create in Hanoi.

Seoul's metro and bus system is more adapted to a dense polycentric urban structure similar to the one found in Hanoi. As shown on the map of *Figure 12*, the transit network allows direct trips from suburb to suburb with only one transfer. Because of the higher density of Seoul (twice that of Singapore), more of the

traffic is underground or above grade. The capital cost of Seoul's metro is, of course, much more expensive than Singapore's shorter metro with its bus feeder system. However, it is also possible to replace some or all of the lines with BRT for a much lower capital cost. The important lesson(message?) is that in a polycentric city a transit system should be grid-like, as in Seoul, and not radial, as in Singapore.

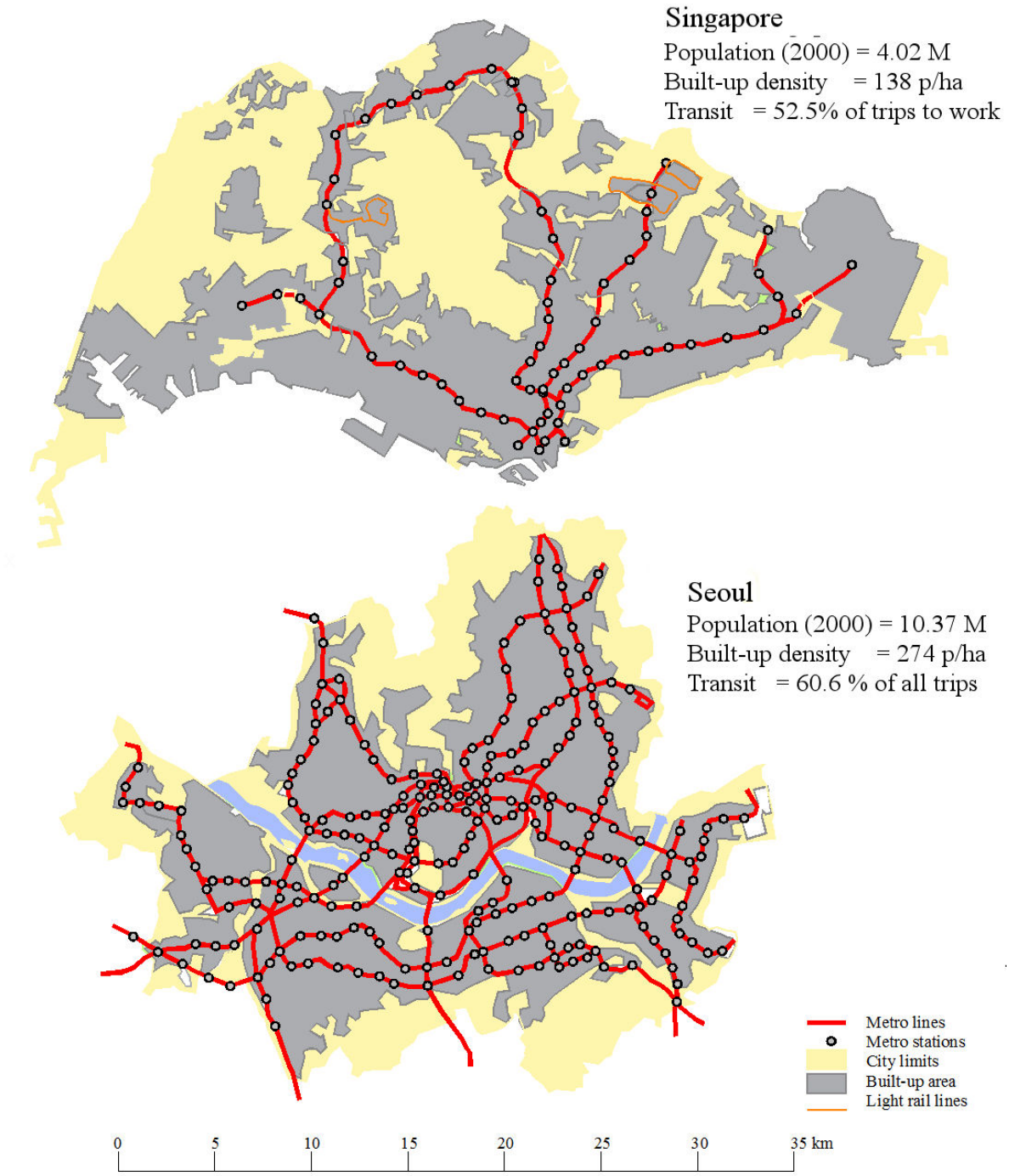


Figure 12: Comparison between the Transit network of Seoul and Singapore represented at the same scale

C. Housing affordability depends on an elastic land supply and on regulations adapted to markets

Land supply elasticity

Insuring the elasticity of land and housing supply to changing price is one of the main objectives of urban planning and infrastructure development. The major role of government in urban planning is to allow land to be developed rapidly in response to demand, wherever that demand is emerging. In addition, the local government should make sure that land parcels are available at a wide range of prices, sizes and standards and that floor space can be built on these land parcels at a floor area ratio commensurate with the land price. When prices are high, land users should be able to substitute capital for land by building higher, and regulations should allow for high floor area ratio. High urban land prices are not necessarily a bad thing if land use regulations allow land to be used efficiently.

The main issue in urban land development is therefore a supply and distribution problem. It is not enough to develop land in quantity sufficient for city expansion. The land developed should be affordable to different income groups and types of business. It should be remembered that land is only an input in the production of floor space. Many steps and many actors intervene between the time land is developed and the floor space built on it is put on the market. The spatial structure of Hanoi is the outcome of this process that transforms agricultural land into urban serviced land and finally into the floor space where most urban activities eventually take place.

Monitoring land markets and rents is therefore an important task to insure an adequate supply of land where demand emerges. So far, no comprehensive land and housing price studies are currently available for Hanoi.

A quick visual survey of 2009 Google Earth images of Hanoi identifies buildings of more than 12 floors that were recently built in the metropolitan area (*Figure 13*). The location of these high-rise buildings is a useful proxy for land prices trends. Developers build high-rise buildings in areas where land is the most expensive and where they assume there is a high demand for floor space. When land is expensive, developers substitute capital for land by building high-rise buildings even though the construction costs per m2 of high-rise buildings is significantly higher than that of the traditional four stories townhouses more common in Hanoi.

The map of *Figure 13* shows a clustering of towers around Pham Hung Road in the southwest part of Hanoi. Some of these towers are commercial; others are

residential. They undoubtedly represent the upper end of the commercial and residential market of Hanoi. The observed pattern of distribution of new high-rise buildings shown on *Figure 13* suggests the following observations concerning Hanoi's land market:

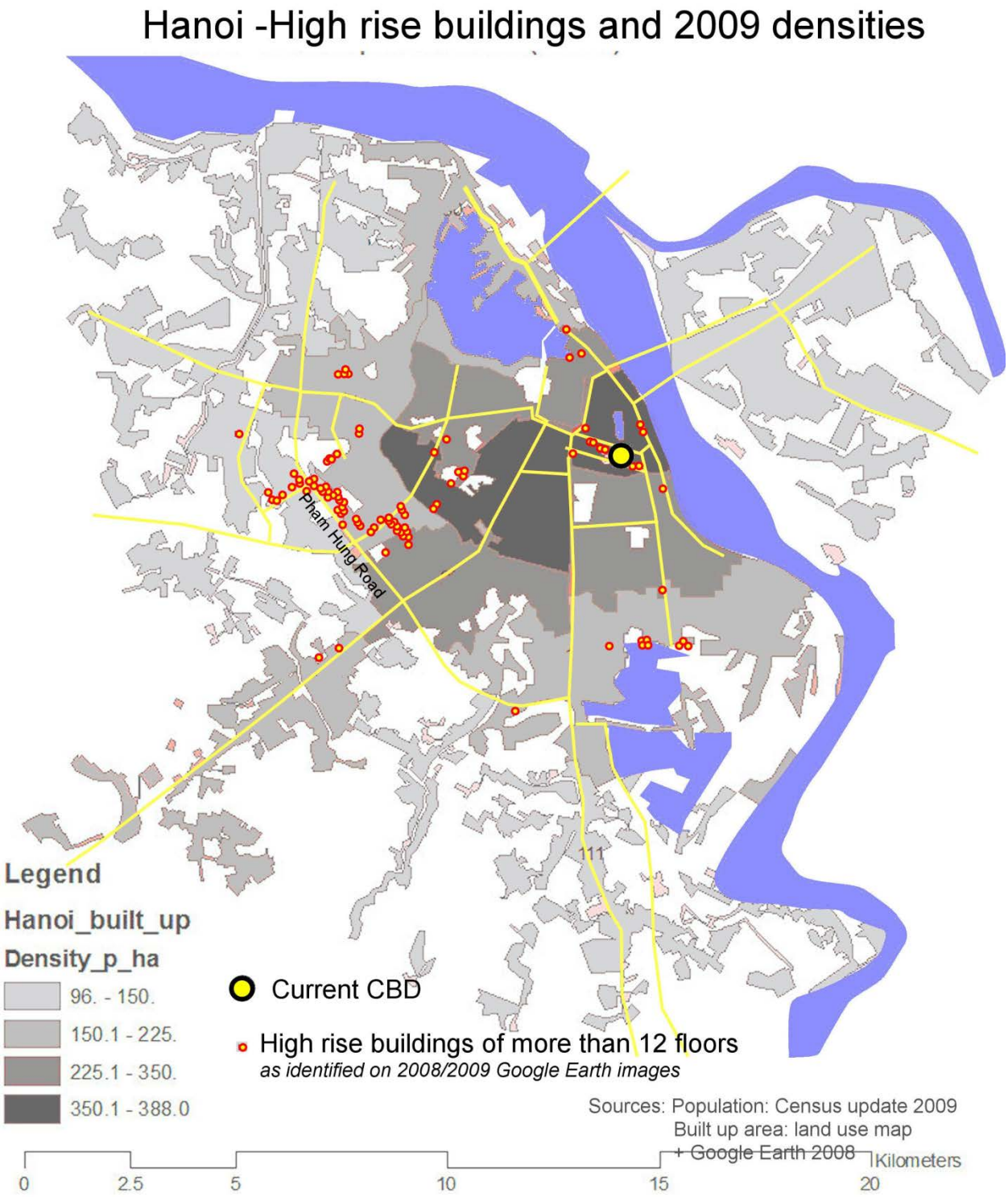


Figure 13: Distribution of high rise buildings and population densities in Hanoi (2009)

- The traditional CBD around the historical French quarter is barely growing;
- There is a dominant cluster around Pham Hung Road, but there is not yet much dispersion along other, newly created arterial roads;
- The spontaneous clustering of buildings in this area shows that the current regulations allow demand-driven development (more on this below);
- The land around this new concentration of buildings will become the most valuable in Hanoi and is likely to become a new CBD with different functions than the traditional CBD in the historical center.

The spatial concentration of high land prices in one area is positive, as it is clearly demand-driven. However, are the high land prices, demonstrated by the clustering of high-end residential and commercial towers, likely to exclude lower income households from having access to housing they can afford in areas adjacent to the new economic center of Hanoi?

The analysis of the land development process in Hanoi and of the local land use regulations, as discussed below, allows us to be optimistic about the possibility for the private sector to develop housing that is affordable to the middle and lower income groups in the vicinity of the new high-rise clusters.

The land development process involved many suppliers

There are four ways of developing land and building floor space in Hanoi:

(1) Formal, large greenfield development by private or semi private developers along major primary road networks planned by the government;
(2) Formal plot by plot development along existing roads by individuals or small developers;
(3) Building of individual, traditional townhouses on farmland by farmers or small contractors;
(4) In-fill of individual, traditional townhouses in existing settlements, often former villages;

The area occupied by traditional townhouses represents around 64% of the total built-up area of the 12 urban districts of Hanoi (*Table 3*). The potential for extension is therefore very large. It is probable that the largest addition to the housing stock every year comes from the development of types (3) and (4) and represents the low end of the market.

Hanoi - agregated land use in the built up area
(12 urban districts, 2008)

Land Use	area (km2)	
Residential traditional townhouses+ commercial	92.424	64%
Residential + commercial	25.915	18%
Institutions and community facilities	10.032	7%
Industries	13.742	10%
Major roads, utilities and railway yards	2.515	2%
	144.628	100%

source: vectorization of Google Earth image of 2008

Table 3: Hanoi Land use in built-up area (extracted from map shown on figure 16 below)

In addition, a large area of floor space is likely to be produced every year by the vertical extension of town houses ("tube houses"), which are traditionally 2 or 3 levels but which are often extended up to 6 or even 7 levels in areas of high demand (*Figure 14*)

Figure 14: Substituting capital for land in Hoan Kiem district

The building shown on *Figure 14* illustrates the way new floor space is created in Hanoi without requiring additional land development. As land prices increase in areas where there is a high demand for floor space, owners of existing building add new floors. This is an important process that increases elasticity of supply and keeps floor space affordable. Such a high building might create a small negative externality for adjacent buildings, and in the long run, it might require some infrastructure capacity adjustments. But these negative externalities are overwhelmingly compensated by the increase in the supply of floor space in areas where it has the most value. In addition, this type of vertical expansion reduces the

need for city suburban expansion in adjacent agricultural areas. Regulations should allow this type of demand driven extensions, unless the negative externalities are obvious, well identified and important. Possibly, a third of the additional floor space to be built in Hanoi in the next 10 years might come from this type of densification.

Ideally, we should be able to put a range of market price per m2 and per housing unit for both the traditional formal residential, the two market driven types of built-up land shown on *Table 3*.

In the absence of market surveys covering the various types of housing we can only infer from anecdotal evidence that the traditional housing sector caters to the middle and lower income groups, while the commercial sector is supplying mostly the upper income groups. Within the traditional sector, the range of prices is very large due to both the different locations and the different level of vehicular accessibility within the same location. Many traditional houses have access to passageways and streets that are only 2 to 4 meters wide. This limited car accessibility prevents the market value of a large part of the current housing stock from inflating too much, as the opportunity cost of land occupied by housing inside a block with limited access is not very high. In a certain way, traditional townhouses located along small lanes constitute a parallel housing market, which might protect low-income households from being outbid by higher income households.

The yearly flow of new housing of this type should insure that it remains generally affordable. However, it is difficult to know how much land gets developed each year in each of the categories represented in *Table 3*.

Land and housing affordability by income group

Household income distribution, shown on *Figure 15*, is an indispensable tool for discussing housing policy. It should be used to monitor the changes in housing affordability, which may occur every year. The traditional terminology, dividing the housing stock between low, middle and high income housing, does not have much operational relevance when, as is the case in Hanoi, household incomes, housing prices and rents change rapidly every year. The income distribution shown on *Figure 15* should be updated every year, and various housing types should be matched to each income interval.

The Hanoi households- distributed by income intervals and represented on the graph of *Figure 15*- are all currently living in a type of house they can afford. We need to find the physical standards and the prices of the housing units each

household can afford under current market conditions. Admittedly, the standards of the housing units of the lowest income groups might be very low, or even socially unacceptable. The threshold below which housing standards are unacceptable should be identified together with the number of households that only afford these unacceptable standards.

The main concern of the planner will then be to identify the potential supply bottlenecks that might contribute to reducing the standards of socially unacceptable types of housing or that might be responsible for increasing the cost of better types of housing. The immediate task to reduce the number of households living in socially unacceptable housing will consist in removing these supply constraints, whether these are due to infrastructure shortages or to regulatory obstacles.

It is possible that for the lowest income groups, demand-side subsidies for housing will be necessary, even after market constraints have been removed. It would then be necessary to identify on the income distribution the number of households that should benefit from this subsidy and to adjust the subsidy to the budget constraint of the government.

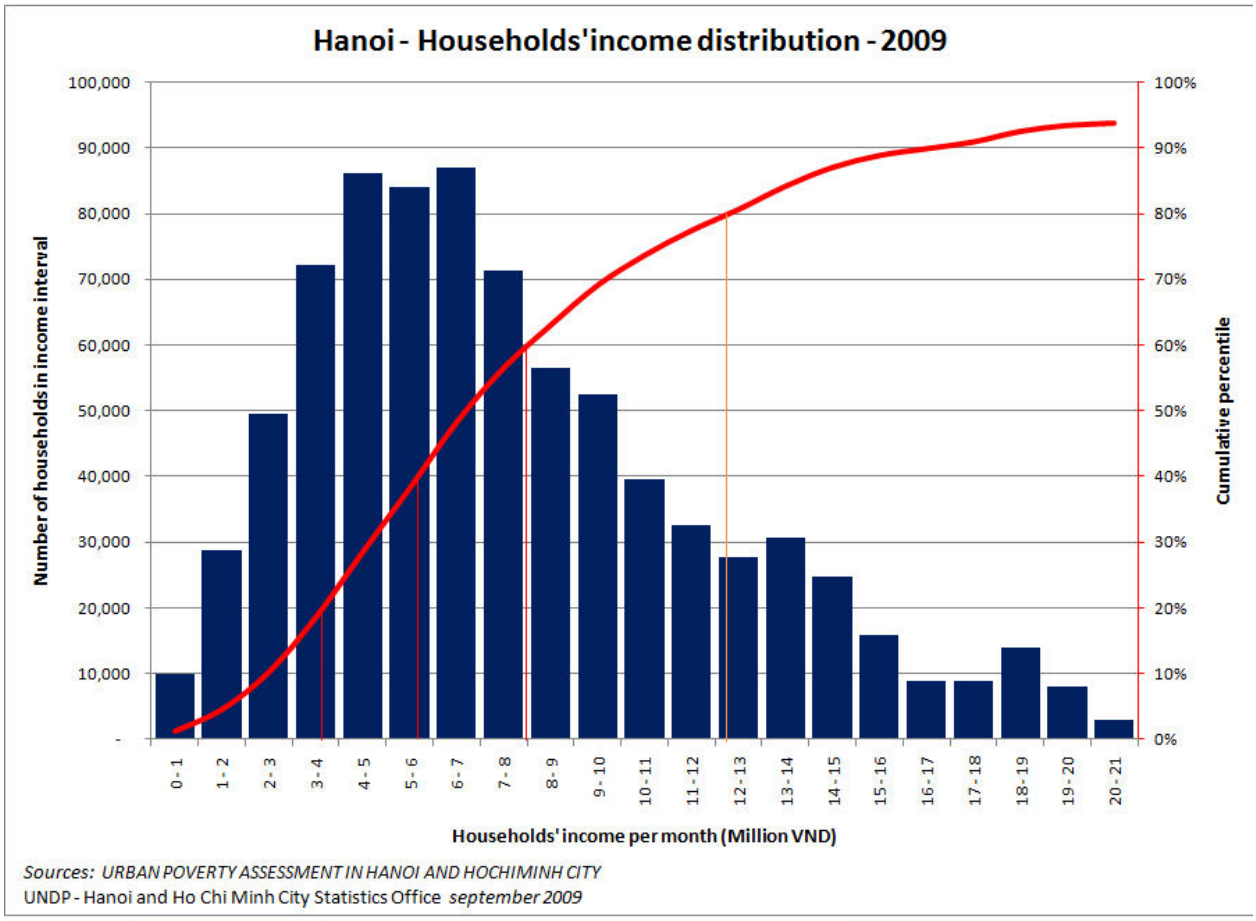


Figure 15: Households' income distribution in 2005

In establishing the affordability threshold of different income groups, it will be necessary to distinguish clearly between the affordability of the existing housing stock and the new housing flow. It is often the case that for the lowest income groups the older, existing housing stock is more affordable and better located than the new flow. Too often, housing affordability is calculated by comparing the prices of the new housing flow to current incomes, ignoring the transaction prices of the older housing stock.

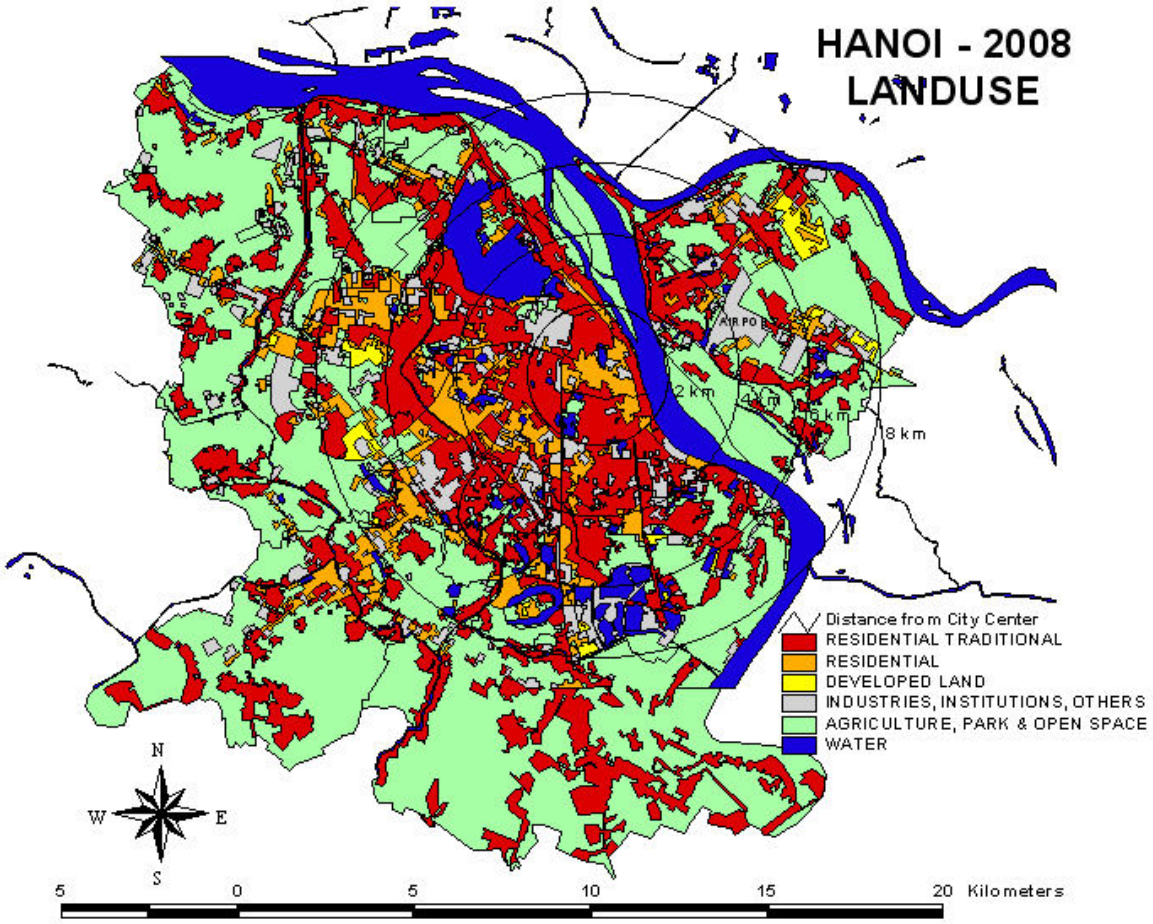


Figure 16: map of the distribution of the two main housing types in Hanoi

Housing affordability, upgrading

The government should also maintain the current diversity of land suppliers, ranging from farmers to formal, large-scale developers. The development strategy currently used in Hanoi, which avoids the demolition and relocation of traditional existing settlements even when they are poorly served by infrastructure, is important for maintaining a steady supply of affordable housing. Upgrading the

infrastructure in these traditional neighborhoods would constitute the best approach for supporting and maintaining affordable housing. The current practice of inserting NUZ (New Urbanization Zones) with high infrastructure standards in vacant land adjacent to existing traditional neighborhood or urban villages will create positive externalities in these low-income settlements while providing access to the primary infrastructure grid network to all income groups.

D. The Land regulatory system

The zoning plan currently being used in Hanoi defines land use, rights of way and floor area ratios. It also contains, by zone, a projection of the expected future population.

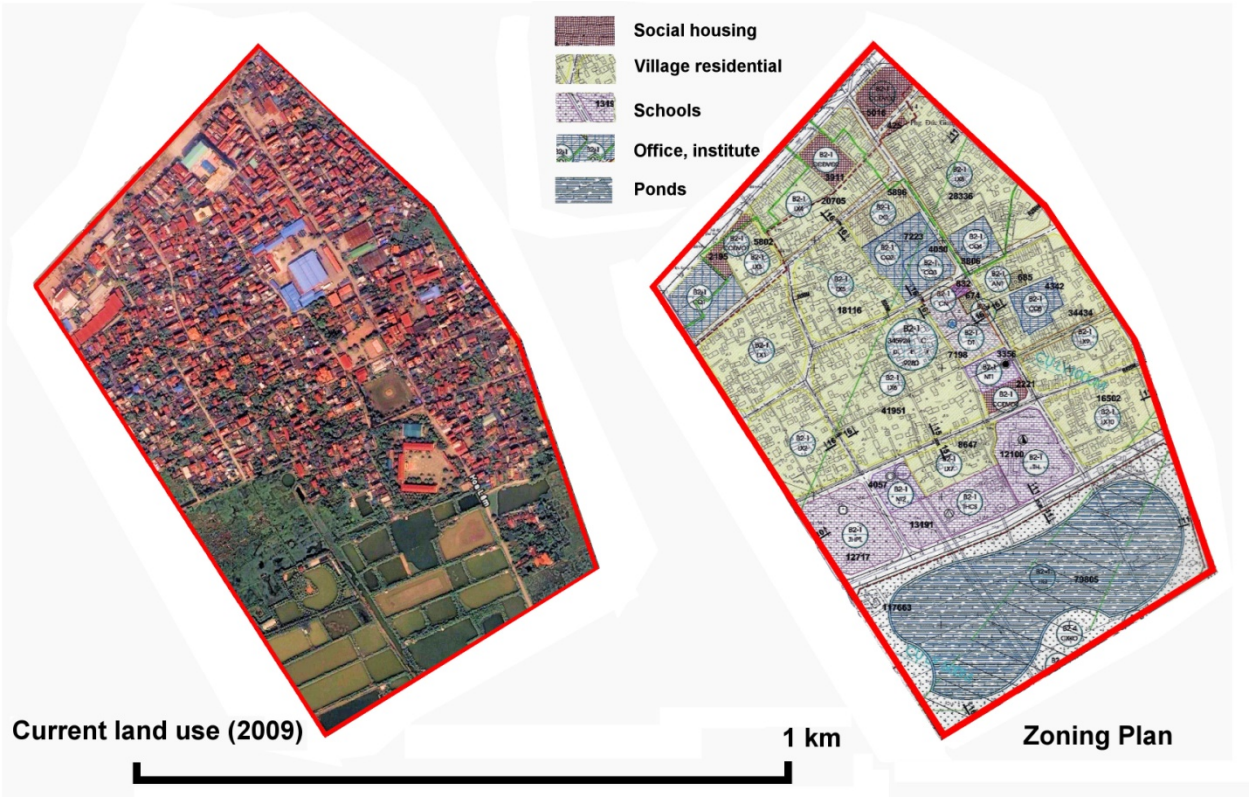


Figure 17: Example of zoning regulations in the Long Bien district

The zoning plan is overlaid on a detailed topographical base map. The zoning concept is very respectful of the former, traditional village settlements (traditional townhouses) mentioned above. The planned development of new areas, and in particular of New Urban Zones, carefully avoids any demolition of the existing, traditional housing stock. The only demolitions that appear on the plans are those for rights of way of major arterial roads. *Figure 17*, extracted from the zoning map of Long Bien District, illustrates the regulatory approach driven by Hanoi's zoning regulations.

Zoning concepts are one thing; getting land development and infrastructure on the ground in a short time is much more difficult in reality. The inspection of a number of Google Earth images taken at different dates in the southwest areas of Hanoi shows that concept plans are being implemented and that the coordination between the construction of the primary infrastructure network and urban development is excellent. The two satellite images of the same area shown in *Figure 18*, taken in November 2002 and October 2008, illustrate this point. In the image on the left (Nov 2002), we can see the beginning of the construction of the primary network and the perimeter of existing, unstructured urban villages.

In the image on the right (Oct 2008), we can see the completed primary infrastructure and the formal development that has been built with minimum demolition and resettlement. New community facilities were built in open fields in areas adjacent to the villages.

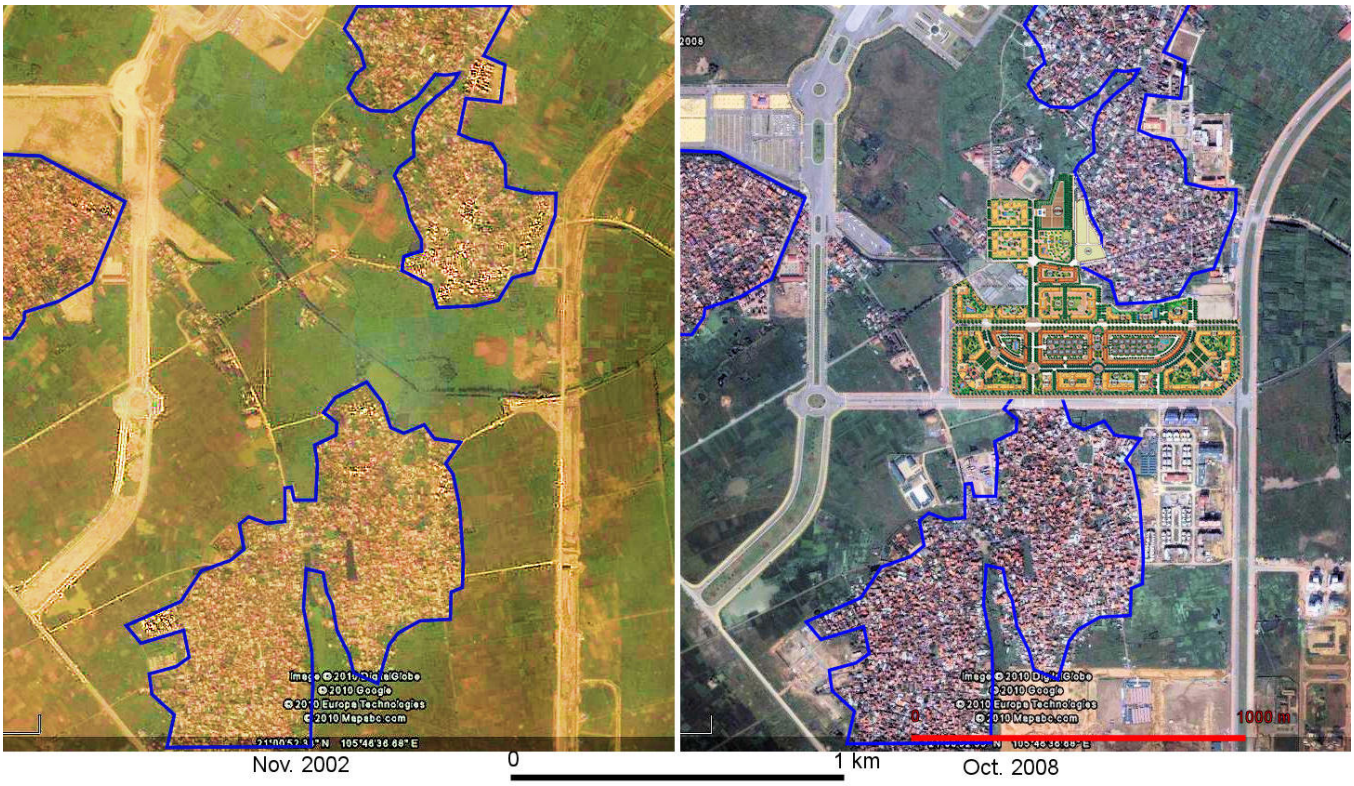


Figure 18: Insertion of formal high-income developments between unstructured, former villages in the southwest of Hanoi

We can conclude that the current planning and land development system in Hanoi shows two very positive aspects:

1) The ability to build primary infrastructure "just in time" for development, and
2) The mixing of formal, high-standard, high-density development with informal, urban village settlements;

It is quite impressive that the private sector in Hanoi has been able to contribute to the supply of new, low-cost housing simply because of its access to land in well-located areas. Making sure that this continues in the future will be one of the major planning challenges.

II. Conclusions: Future growth, mobility and affordability in Hanoi

The land development process in Hanoi is largely efficient in terms of land use, income mix and development of primary infrastructure.

The existence and formalization of large, dense urban villages in the periphery of Hanoi allows for a parallel market, which in turn insures a supply of low-income housing in every location of the city.

The quasi-universal use of the motorcycle as a dominant mode of transport has resulted in high labor mobility and is certainly responsible in part for the economic growth generated in Hanoi. The motorcycle is well adapted to the current road network, consisting of a widely spaced grid of vehicular roads connected to capillaries of tertiary, narrow passages and alleys.

Even so, the main planning issue facing Hanoi in the future is likely to be that of a deteriorating mobility. How can mobility be maintained in a city where income is increasing quickly but the density is too high and the road space too small to permit private car use from becoming the dominant mode of transport?

The planned transit network, even if amended to better reflect density shifts, will not have an immediate impact on land use or on mobility. It will take at least a decade before the first impact of a new transit system is felt. The urban transport strategy should therefore consist of two components.

The first component of the strategy should consist of making current motorcycle use safer and more efficient while also slowing down the use of

individual cars by restricting car parking to off-street, privately operated, unsubsidized sites.

The second component of the transport strategy should consist of developing a transit system that will provide good access to the areas where jobs are concentrated. The role of transit is not necessarily to become the dominant mode of transport over the years. Rather, it should provide an efficient and convenient means of access to the various centers that will emerge, in which the high density of jobs, commerce and amenities would make individual means of transport impractical without creating unmanageable congestion.

Maintaining mobility and insuring housing affordability for all will be achieved not by meticulously planning land use and infrastructure long in advance but by monitoring demand for land, housing and commercial space and by adjusting infrastructure investments and urban regulations to maintain a price-elastic land supply.

A. Annex 1 catchment area of projected UMRT

Evaluation of the number of people within the transit stations catchment areas

Station number	Area of stations' catchment areas (km2)	density (p/ha)	population in stations catchment areas
1	1.1310	96	10,857
2	1.1310	96	10,857
3	0.9533	346	32,954
4	0.9533	346	32,954
5	0.9533	346	32,954
6	1.0260	388	39,809
7	1.0260	344	35,294
8	1.0260	259	26,573
9	1.1310	82	9,274
10	1.0591	124	13,132
11	1.0591	124	13,132
12	1.0591	124	13,132
13	1.1310	204	23,072
14	1.1310	292	33,024
15	1.0059	292	29,372
16	1.0059	292	29,372
17	0.9533	346	32,954
18	0.9533	346	32,954
19	1.0814	204	22,061
20	1.0814	204	22,061
21	1.1065	296	32,751
22	1.1065	296	32,751
23	1.1310	292	33,024
24	0.9533	346	32,954
25	0.9533	346	32,954
	26.1019	253	660,228
			22%
Total population (1) in 2009=		188	3,044,455

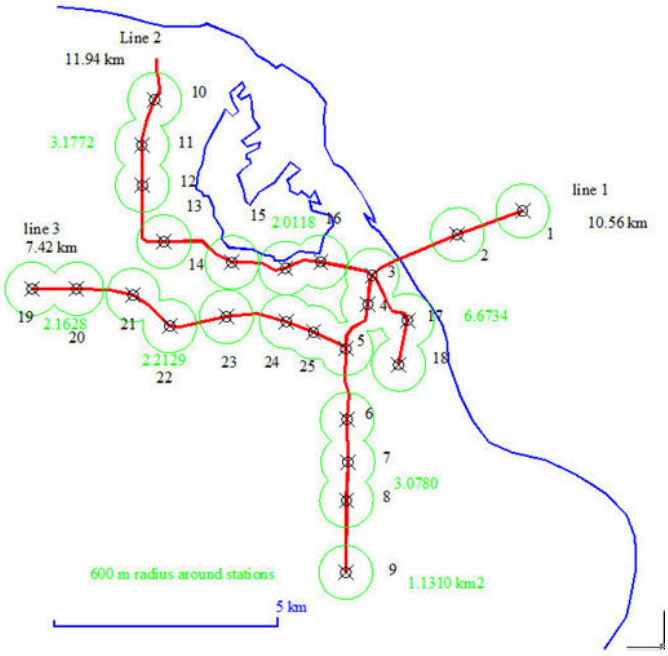
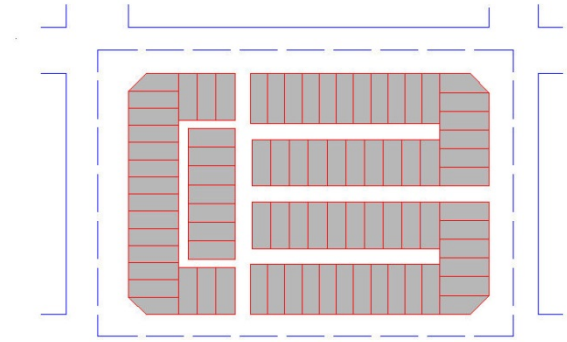


Figure 19: catchment areas of the 25 stations of the projected UMRT

B. Annex 2 Housing Typology

Comparison between new "Tube Houses" in Hanoi Dinh Cong New Urban Zone and New York "old law tenenments"

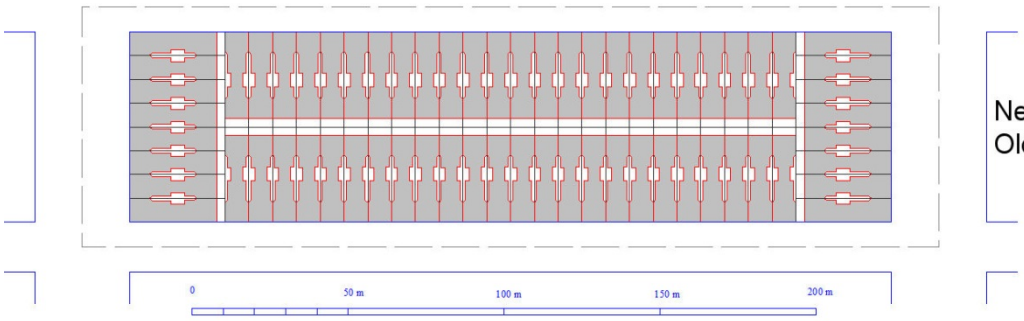


Hanoi new tube houses (2006)

Comparison Between the land use of New "Tube Houses" in Hanoi and tenements in New York Cities

	Units	Hanoi new tube Houses in Dinh Cong New Urban Zone	New York Old law tenements as originally occupied
lot size	m2	99	232
Building foot print of one tenement	m2	89	180
block area	m2	8,042	14,864
Including street axis	m2	12,206	21,112
Number of lots	lots	81	64
total footprint as % of lot area	%	90%	78%
Number of floors		4	5
Net FAR		3.59	3.89
Gross FAR		**2.37**	**2.74**
Number of apartments per floor		2	4
gross area per app	m2	44.59	45.12
Area used by staircase and corridors per floor	m2	10.76	26.00
Net area of apartment	**m2**	**39.21**	**38.62**
dwelling density	**dw/ha**	**531**	**606**
Average person per dw	person	4	5
population density per block	**p/ha**	**2,124**	**3,031**
percent of area used by roads	%	34%	30%

Sources: Hanoi, measurement of a block on Google Earth at 20° , 59', 18,90" N - 105 ° , 49', 53.81" E in Dinh Cong New Urban Zone
To Kien, 2008, "Tube Houses" and "Neo-Tube Houses" in Hanoi: a comparative study in indentity and typology, Journal of Asian Architecture and Building Engineering/November 2008/262
New York: Andrew S. Bolkart "Biography of a tenement house in New York City"



New York City
Old law tenements

C. Annex 3 Relationship between density, car ownership and road area in various cities

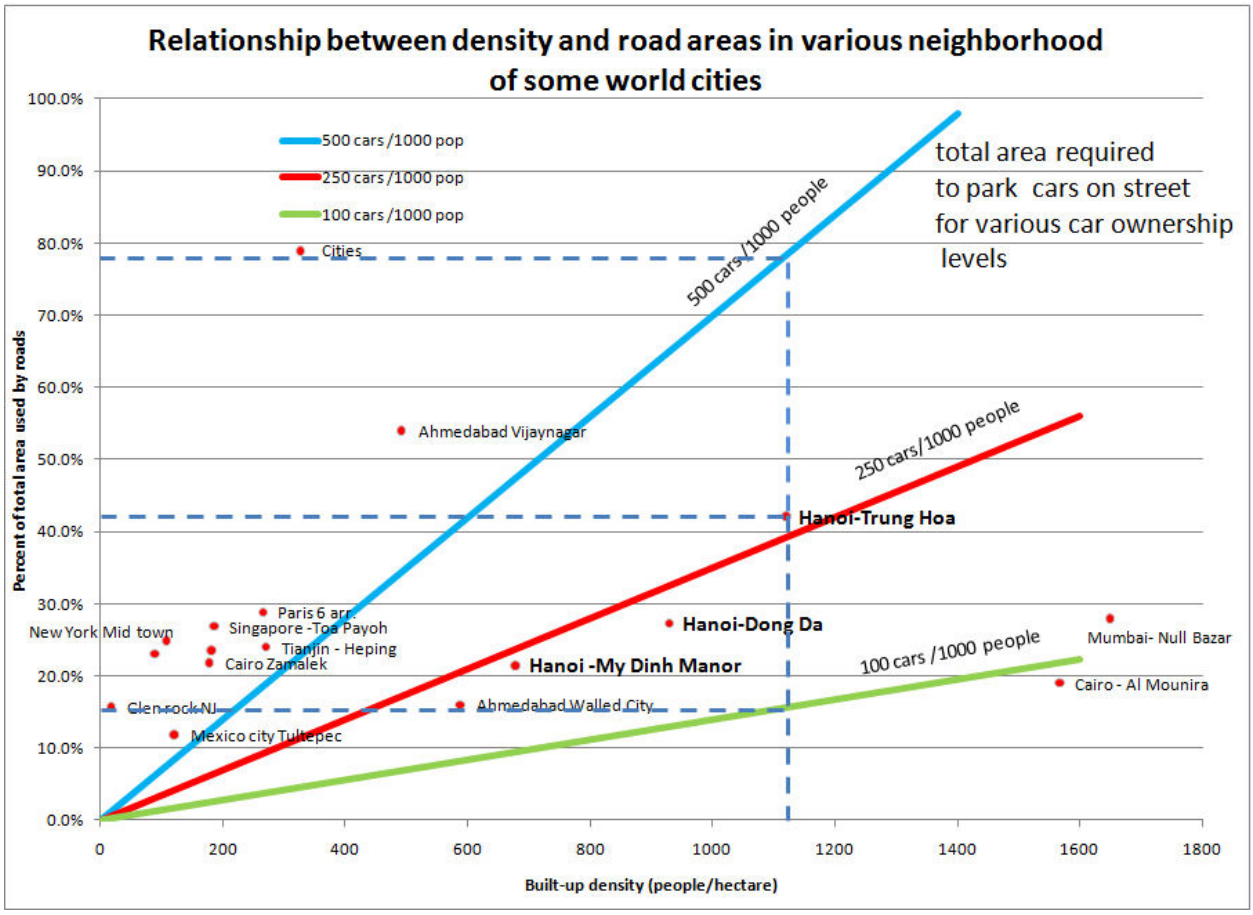


Figure 20: relationship between car ownership and densities

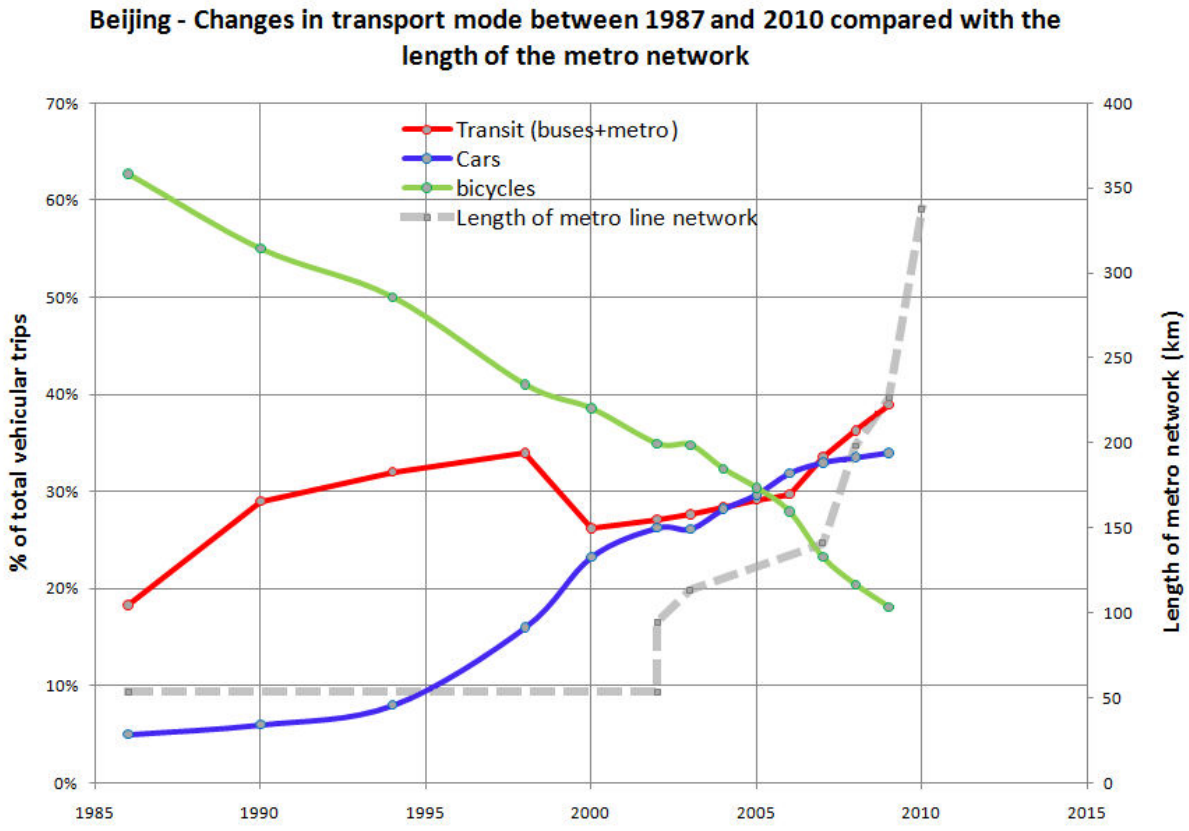
D. Annex 4 Beijing changes in main transport mode

Beijing transit: an example of transport infrastructure lagging urban land supply

The sequence of the change of transport mode in Beijing illustrates how trends in transport mode can be anticipated and acted upon to improve mobility (*Table? 1*). In 1987, the bicycle was the main mode of transport in Beijing, comprising 63% of trips. As the city expanded, bicycles became less convenient, and the proportion of transit trips increased until 1997. In 1994, the number of car trips started increasing as household incomes grew. The breaking point seems to have been in 1997 when both bicycle trips and transit trips decreased dramatically while car trips increased from 16% to 23%. Because of the high density of Beijing, combined with the relatively small area devoted to streets (in spite of few very broad avenues and the limited-access ring roads), cars do provide a significant speed advantage over buses during traffic congestion as they do not have to stop to pick-up passengers. In the absence of a faster alternative, therefore, those who can afford to do so switch to cars. Between 1990 and 2004, the failure to expand the metro network in order to provide a faster alternative to buses made car travel the most convenient, alternative transport mode and pushed passengers who could afford them to this mode. It took the massive investments in metro line building between 2002 and 2010 to slow down the growth of car trips (grey broken line on graph of *Figure 21*).

In a city the size and density of Beijing, when greater than 30% of the transport share is claimed by car trips, permanent congestion is certain. This congestion is further exacerbated because car use is very much linked to income and because most of the car users reside in the city center and generate trips within or close to the center(data from BTRC 2009). In cities like New York and Paris, car trips comprise a higher percentage of total transport modes than they do in Beijing, but the great majority of car trips are from suburb to suburb, where densities are low, and most of the trips to and within the CBD utilize transit.

The example of Beijing shows how the timing of investment to anticipate major transport mode shift is essential to avoid heavy congestion that may affect urban productivity.



Data sources: Beijing Transportation Research Center

Figure 21: Change in transport mode in Beijing between 1987 and 2010

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