V

Mobility Issues in the New Emerging Metropolitan Areas

Alain Bertaud

We are ill prepared for planning the transport infrastructure of large megacities because we stick to obsolete models like the ones offered by Curitiba, Copenhagen, or Bogota. These cities, while innovative in their past golden ages, have spatial structures and scales that are very different from those observed in new megacities. Their experiences are not transferable to megacities.

Transport planners are either not monitoring the land use changes that are occurring in megacities or have the illusion that whatever transport system they design will by itself modify existing spatial structures. Urban planners are even more oblivious of emerging land use changes and tend to be guided by benign but abstract slogans such as smart growth, sustainability, and livability. These slogans are not conducive to devel-

oping measurable objectives and distract from the real goal of spatial planning, which should be to insure labor mobility and housing affordability as cities' shapes are transformed by rapid migration, technology, and exogenous economic trends.

The inability to analyze the ground reality in megacities results in large investments in obsolete transit technology. Inefficient cars and minibuses become the preferred mode of transport for a majority of metropolitan commuters. These inefficient modes of transport are fragmenting labor markets, constraining urban land supply, maintaining a large part of the population in poverty, and imposing long commuting travel times that are socially disruptive.

In this context, I have identified three research topics, which should be pursued if we want to improve the labor mobility in megacities. First, what differentiates the spatial structure of new megacities from the structures of the cities that preceded them? Second, could the extension of traditional transit systems, consisting of metro and/or bus rapid transit (BRT) networks, constitute a long-range solution to labor mobility in the new megacities? Third, how can metropolitan transport research be oriented to find new transport systems that would insure the mobility of the labor force in megacities?

The approach I propose is based on my conviction that transport systems have to adapt to existing urban spatial structures. This contradicts the current received wisdom that whatever transport systems planers prefer will be shaping future urban structures. The decline in use of mass transit systems in the last 10 years and the rising use of individual cars and minibuses seems to confirm that a new approach is needed. The complex

megacities' urban shapes are reflecting the individual location and consumption choices of millions of households and firms; they are not the product of planners' design.

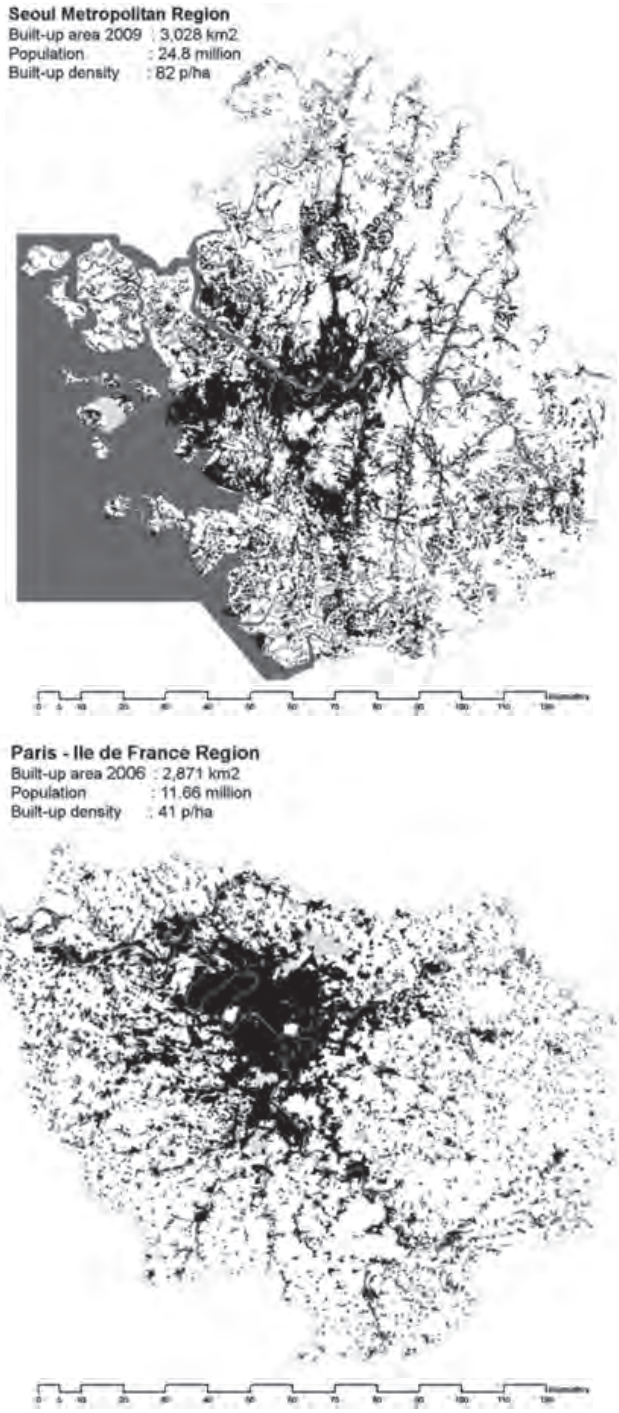
The spatial structures of new megacities are not scaled replications of smaller cities.

Twenty-four megacities of more than 10 million people have emerged during the last 30 years. An additional 35 cities are likely to pass the 10 million mark in the next 20 years. These megacities were not planned, they just "happened." The economic efficiency of large labor markets generates these new urban shapes.

The spatial structures of megacities are not a larger-scale reproduction of smaller cities. Megacities retain still dense central business districts (CBDs), but these contain only a small fraction of the total number of metropolitan jobs. The majority of job locations are dispersed into very large, semi-continuous suburban areas that often cover more than 10,000 square kilometers. For instance, the metropolitan areas of Seoul and Paris, represented at the same scale on Figure 5.1, have a built-up area of respectively 3,000 and 2,900 square kilometers spread on a metropolitan area of more than 12,000 square kilometers each. In both cities, the distance between the traditional historic CBD and the fringe of the suburban area is over 80 kilometers.

Nobody yet understands fully the way labor markets work in such large and complex metropolitan areas. Does the theoretically large metropolitan labor market fragment into smaller submarkets whose size is constrained by the commuting speed?

Figure 5.1: Metropolitan Built-up Areas of Seoul and Paris Represented at the Same Scale



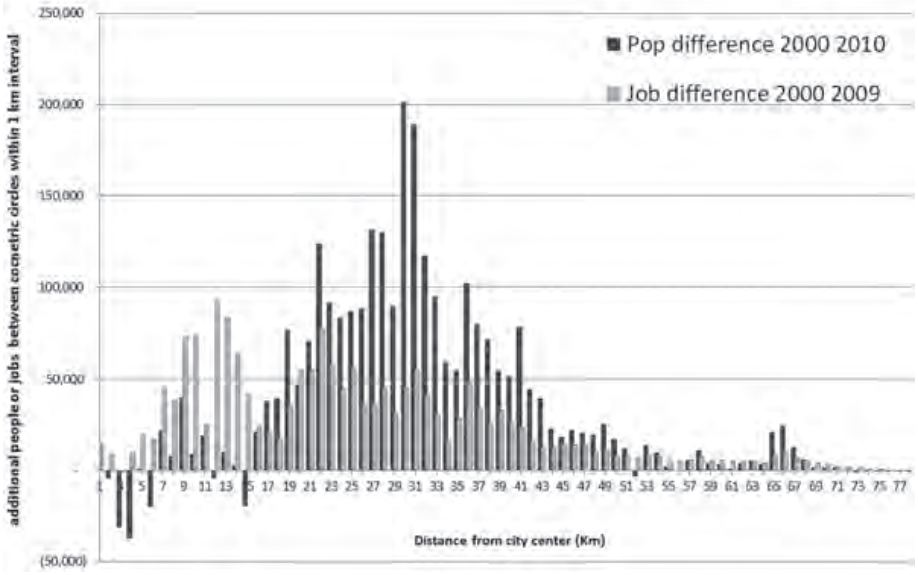
Source: Google Earth image digitized by Marie-Agnes Bertaud.

Or do commuters travel very long distances to increase their access to a maximum number of potential jobs?

In Seoul, the trend in both job and population distribution over a period of 10 years between 2000 and 2010 seems to point to continuous spatial dispersion of jobs and population (Figure 5.2). Over the same time period, the population in and around the CBD decreased and the number of jobs barely increased. More than two thirds of the jobs and 90 percent of the population added over the 10-year period were located more than 20 kilometers from the traditional CBD.

In Seoul, this growing dispersion of jobs and population over a large metropolitan area is not due to a laxity in land

Figure 5.2: Increase in Population and Jobs by Distance from Seoul City Center between 2000 and 2010



Sources: Population and jobs: census data. Built-up area and densities: GIS Analysis Marie-Agnes Bertaud.

use control or to a failure in developing a transit system. During the last 30 years, Seoul authorities have strictly enforced a green belt zone around the core municipality in order to slow down suburbanization. The Seoul Metro transit network, with 740 kilometers of rail lines, is the longest in the world, twice the size of New York's rail transit system. However, in spite of green belt regulations and massive transit investments, the Seoul metropolitan area is spreading over an area of more than 12,000 square kilometers, as shown in Figure 5.1 and Figure 5.2. The example of Seoul and other megacities seems to demonstrate that there is a fundamental self-organizing principle in the growth of large labor markets that contradicts the conventional anti-sprawl strategy prevalent among municipal urban planning departments around the world.

The dispersion of labor markets over large areas is not limited to sophisticated economies like Seoul, Paris, or New York, with populations able to afford the transport costs inherent to suburbanization. The tragic collapse of the Rana Plaza building in Dhaka in 2013 brought to international attention the inability of local governments to enforce elementary building safety regulations in fast-growing metropolises. It also exposed a dramatic change in the land use of metropolitan Dhaka, which seems to have gone unnoticed.

Rana Plaza was part of a mixed-used commercial industrial complex located in Savar, a semirural subdistrict of the Greater Dhaka Area (13 million people), located 26 kilometers from Dhaka's center. The astonishing fact was that the eight-story building that collapsed had 5,000 employees with a net density of 10,000 jobs per hectare. The gross job density in the entire neighborhood was about 3,500 jobs per hectare, about 50 per-

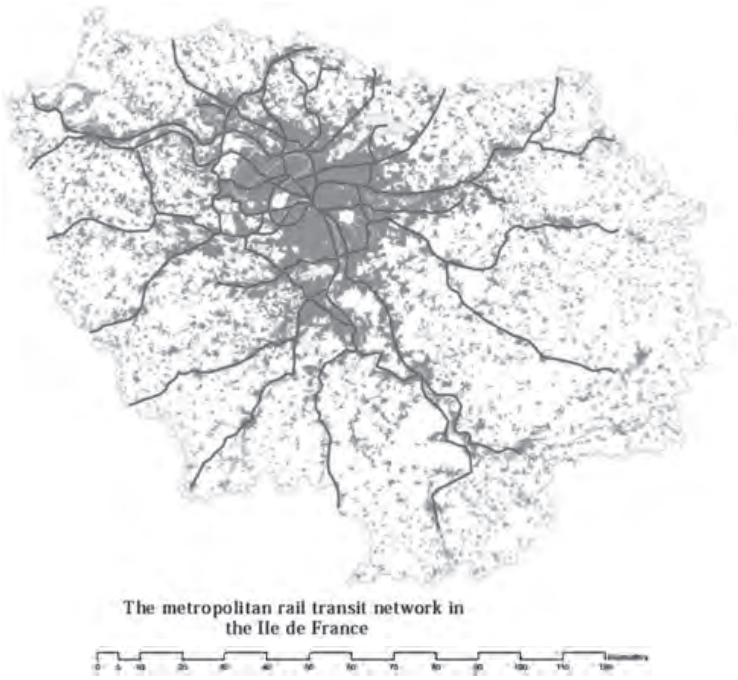
cent higher than the gross job density in Midtown Manhattan! The high job density in Manhattan is easily explained by its extraordinary accessibility at the very center of a web of transit lines and roads serving a large metropolitan area. How is it possible that a distant suburb of Dhaka with poorly performing buses could provide access to such a high spatial concentration of workers normally found only in the CBDs of large cities? Of the eight floors that collapsed, three were built illegally. Why was there such a high demand for concentrated industrial floor space in such a remote area?

The tragedy of Rana Plaza illustrates the changing land use patterns in metropolitan areas that are not well understood by planners and by local authorities. The functioning of large labor markets spontaneously creates these new spatial structures. Unfortunately, planners are trying to contain these spatial expansions instead of analyzing the mechanisms that create them. Once understood, these new emerging urban spatial structures should be supported with infrastructure investments that increase mobility.

Metropolitan transport systems based on radial rapid transit and feeder buses are unable to serve the growing population and jobs located in the large suburbs of megacities

Let us look at the current transport system in metropolitan Paris (Figure 5.3). The map on the left shows the built-up Paris metropolitan area (12 million people in 2012) with the rail

Figure 5.3: Paris Metropolitan Area: Comparison between Rail Transit Network and Pattern of Commuting Trips



Source: Direction Generale de l'equipement de I'lle de France; Google Earth digitized by Marie-Agnes Bertaud.

transit network serving the region (for clarity sake the metro rail lines serving the municipality of Paris at the center of the region are not represented). The red arrows on the map on the right are showing the volume of commuting trips by origin and destination from and to three geographical locations: Paris municipality, close suburbs, and outer suburbs.

The transit network is radio concentric and provides good access to Paris municipality (18 percent of metropolitan population but 31 percent of the total metropolitan jobs) but it does not provide convenient access to the 69 percent share of metropolitan jobs located in the suburbs. As in Seoul, the majority of new jobs are created outside Paris municipality. Therefore, the transit network's inability to provide access to jobs located in the suburbs will likely become worse in the future.

As expected, the volume of commuting trips closely reflects the proportion of jobs in Paris municipality and in the suburbs. Seventy percent of total trips in the Paris metropolitan are from suburbs to suburbs, while 30 percent are from suburbs to Paris municipality or within Paris. The majority of commuting trips from suburbs to suburbs are done by individual cars and to a much lesser extent by motorcycle.

Could the existing transit network be extended in the future to provide adequate access to suburban jobs? This is unlikely, as it would require an intense grid network of rail and feeder buses covering an area of 12,400 square kilometers with a low population and job density. Trips from suburbs to suburbs involving multiple origins and multiple destinations would have few passengers and would require many transfers, resulting in high operating costs for the operator and long commuting trips for the users.

The current transit network as shown in the left panel of Figure 5.3 is probably close to an optimum network for both the transit operator and for users, although it serves only a small portion of total trips. The car is the main and faster mean of transport for about 65 percent of trips that are from suburb to suburb. Cars and motorcycles are the most convenient mode of inter-suburb transport. They provide door-to-door travel without lengthy mode changes, they are on demand, and they are not dependent on a schedule as it is the case for transit.

However, cars, as currently designed, are far too heavy and large for efficient transport, especially as they usually are carrying only one passenger. In addition, cars occupy too much valuable real estate, both while parked and moving. The land area required by current-sized cars parked and moving at different speeds is shown in Table 5.1. The land consumption of cars used for commuting is compounded by the fact that one car requires several parking lots: one parking space at the origin of trips next to the car owner's home, one at the place of work,

Table 5.1: Land Requirements for Parked Cars and Cars Moving at Different Speeds

Parked/moving cars	m^2
Parked car on street	14
Parked car in public parking	22
Car stopped in a traffic jam	24
Car at 15 km/h	40
Car at 30 km/h	65
Car at 60 km/h	115

Source: Direction Generale de l'equipement de I'lle de France.

and additional parking space in commercial areas. It has been estimated that in Houston, for instance there might be about 15 parking spaces per car. That would be 330 square meters of parking area per car, more than 50 percent larger than the median new house area (201 square meters) in the United States in 2010!

Over the last 20 years, technology has greatly decreased the pollution caused by cars. In a few years, electric cars will likely be the most common technology used by urban cars. Their energy efficiency will greatly increase, to the point of decreasing their greenhouse gas emissions per passenger/kilometer to below transit levels. However, the space required by individual cars makes them a clumsy mean of urban transport that requires expensive infrastructure and land.

In less-affluent metropolises like Mexico City, Manila, or Gauteng, for instance, microbuses or rickshaw taxis are now becoming the major transport mode for suburb-to-suburb trips. But as soon as households reach the income threshold required to afford a car, they switch to a car as their main commuting mode. Microbuses and rickshaw, although the preferred mode of transport of the poor in metropolitan areas, are usually not integrated into future transit policies by metropolitan planners.

What kind of transport system is likely to improve mobility in megacities?

Let us summarize the transport situation in megacities. First, transit is efficient only for a fraction of the commuting trips within the dense city core and from suburbs to the urban core.

However, for trips from suburbs to suburbs, which are becoming the majority of commuting trips in megacities, transit is not financially viable to operate and is inconvenient to users. The inconvenience of transit for suburban consumers is compounded by the necessity of transferring between lines and between modes (bus to rail or rail to bus).

Second, cars and motorcycles are the most convenient mode of transport for suburb-to-suburb trips. But they consume a large amount of land and require large infrastructure investments in highways across metropolitan areas. Cars, however, are the most convenient mode of transports for users because they provide on-demand transport, door to door, without the rigidity of a schedule and a fixed network, as it is the case for transit.

The main topics of research for metropolitan urban transport research should therefore be able to answer the following questions:

1. How to reduce the area of land used by individual vehicles?
2. How to combine transit and individual modes of transport to provide transport from station to door and door to station?
3. How to transition between the existing transport systems combining transit, minibuses, motorcycles, and cars?

This chapter cannot provide answers to these complex research topics. However, some technological changes are already pointing toward possible solutions. For example, it is becoming easier to price the road space used by moving cars by charging congestion fees that vary by time of day and vehicles' footprints.

A number of automobile manufacturers like Toyota, Hyundai, and BMW are producing prototypes of what they call Individual Urban Mobility Vehicles (IUMVs). These are fully enclosed electric motorcycles for two passengers that use only half a lane width when cruising. These vehicles are extremely stable compared to ordinary motorcycles.

Distance between moving cars could be reduced by equipping every vehicle with an adaptable cruise control. This technology already exists but is only available on high-end cars. An IUMV equipped with adaptable cruise control could reduce the road space of moving cars by up to 75 percent.

The current research conducted by Google on self-driving cars will ultimately greatly reduce the distance required between moving cars and will reduce the number of cars required for individual transport.

Finally, it should be possible to combine low-land-consumption IUMVs with transit for long distance, if transit stations included parking with IUMVs immediately accessible to passengers. In a first stage, the parking around transit stations could be used by rickshaws. In Paris, a new public service providing self-serve rental electric cars, called "Autolib," includes 2,000 cars spread over 1,100 rental stations around existing subway stations and suburban rail stations.