Can Western mobility solutions apply to East Asia's cities ?

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ABSTRACT - Cities around the world are experiencing traffic congestion and test different solutions to insure adequate mobility for their inhabitants while at the same time taking into consideration the relatively new concern for sustainable development.

Several Western countries, such as France and the United States, have seen a resurgence of streetcars/tramways as a way of enhancing mobility at a lower environmental cost in central parts of their cities. Many European towns have embraced the concept of bike sharing. Reflections on the urban environment have led to transit-oriented-development schemes.

This presentation considers the relevance of such schemes in Asian cities characterized both by very high population densities and a rapid increase in motorized transportation. Is T.O.D. an option ? What is easy in low-density Denver suburbs may be difficult to implement in Asia. Are streetcars a better solution than bus rapid transit lanes on the Brazilian Curitiba model ? Singapore's congestion charge policy has become model for Western cities such as London.

Several Asian cities have built elevated monorail systems, which are not in the plans for most European or American cities. As bicycles are returning to the streets of Paris, their use tends to be restricted in Beijing or Shanghai.

Metropolization is a major trend of the 20th century. Today, 50% of the world's population lives in cities, more and more in very large cities. The number of urban agglomerations over 2 million people is increasing dramatically around the world. The speed of urban growth is much faster in developing countries than it was in Europe a century ago. For instance, when London took 130 years to grow from 1 to 8 million people, Bangkok only needed 45 years, Dhaka 37, and Seoul 25 years (Giraud & Lefèvre 2006).

The 20th century was also the golden age of the automobile, as the 19th century was, at least in industrialized countries of the West (Europe and United States) the age of railroads. Urbanization is now heavily influenced by the car, and many Western households having moved out to the suburbs now need several cars to satisfy their mobility needs.

Uncontrolled growth in urbanization and motorization raises serious concerns about the social, economical and environmental sustainability of transport systems. In the developing world, poorly maintained vehicles, slow moving traffic and ever-expanding urban boundaries make commuting longer and more expensive. Following the American pattern of suburbanization expanding towards less-crowded, green environments, sprawl now reaches deep into rural and agricultural areas. After moving rapidly towards an American-style mode of mobility based on automobile use, European cities are now embracing a more balanced, multi-modal approach taking into account the need to preserve the environment and provide alternatives to the automobile (Ascher 2003, Papon 2003). No longer a theoretical topic, urban sustainable development must be put into practice by green transportation policies. Car use in cities needs limits and priority has to be given to public transport, pedestrians and cyclists - all measures which will improve the quality of life in urban areas. Some American cities are following this new trend.

What happens, then, in Asian cities ? This paper will review the main problems and policies of urban transportation, in a comparative mode between American and European cities on one side, Asian cities on the other side.

1. Cities, mobility and traffic congestion

Mobility, especially mobility relying on the automobile, has become one of the core dynamics of contemporary societies (Ausubel & Marchetti 2001, Allemand, Ascher & Lévy 2005). At the heart of economics, where globalization implies an ever-increasing reliance on logistics and transportation of goods and people, it is also a powerful maker of social status and a symbol of personal freedom. This freedom has thus become the condition for individuals to be able to exercise personal choice in many spheres. Public transportation, when it is available, still represents a constraint, because fixed schedules and routes give the passenger the impression of incomplete mobility, and the close proximity to strangers maybe perceived negatively and somehow dangerous. When they have the financial means to do it, urban dwellers dissatisfied with

unresponsive and obsolete public transportation systems enter the automobile society. Public transportation becomes relegated to a secondary mode of travel, left by default to people with no other choice, even when the transit fleet of overcrowded buses is obviously insufficient.

Urban transportation in developing countries is now a major policy issue (Prudhomme 1990). Efficient transportation can be considered as a necessity for economic development in a globalizing world, when inefficient transportation means inefficient cities and hence inefficient countries in the worldwide competition for capital investment. Fancy new airports and deep-draft harbors are not sufficient if the roads in the cities they serve cannot handle traffic and people.

Most of the growth in motorized travel has come from large metropolises. Cities around the world have experienced a rapid growth in automobile use by their residents (Cameron, Lyon & Kenworthy 2004), as well as motorized 2-wheelers or 3-wheelers. Worldwide increases in motorized urban mobility can be linked to population growth, urban sprawl, increased affluence in developing and emerging nations leading to a wider car ownership, and decreases in vehicle occupancy. In China, the best example of exploding growth in the last 25 years, the rise in automobile ownership has been phenomenal : 175.000 cars in 1984, 816.000 in 1990, 2,5 million in 1995, 8,5 million in 2000, 14,8 million in 2003, and 24,4 million in 2008 (Doulet & Jin 2000, Lu 2002, Wu 2005)[1], of which 70% are found in large cities. The country has now become the second-largest market in the world behind the United States, even if the rate of car ownership remains low in contrast to Europe and North America.

The result has been a growing pattern of gridlock and hours lost in traffic (Schrank & Lomax 2005). « Embouteillages » in Paris or Lyon, « traffic jams » in Washington DC or Los Angeles have become an expected part of daily life for many years, including in suburban areas (Cervero 1986), despite the latter's huge network of urban freeways separated for regular street traffic. In Europe (Olson & Nolan 2008), London, with an average speed of travel of 19 km/hour, seems to be in the worst position followed by Berlin, Warsaw and Manchester, but Athens also is often singled out for its horrendous traffic. The phenomenon is not limited to Western industrialized countries.

Nowadays, most cities in the world are facing traffic gridlock. Cities of the First World have been replaced as the worst cities for traffic by metropolises in developing and emerging countries, where the rise in personal income has led to a even faster growth of the number of vehicles in the streets, quicker than the development of infrastructures needed to accommodate them. Bangkok, Manila, Cairo, Lagos, São Paulo and Mexico City are often cited as « world capital of traffic jams », even with lower car ownership than in the West. Post-Soviet Moscow and fast-growing Dubai are also experiencing a rapidly deteriorating commuting situation. In Beijing, where it was still odd to see an automobile in the late 1970's, more than 3 million cars ply today the streets of the Chinese capital, and gridlock is severe on its peripheral beltways. Beijing, once a city of bicycles, has become a city of cars (Sit 1996, Doulet 1999, 2001, 2002, Zhang & Gao 2008).

Traffic congestion has many negative side-effects. Many productive hours are lost as a result of traffic congestion[2]. Trapped in heavy traffic, buses in some cities are now slower on peak-hour than the horse-drawn « omnibuses » of 100 years ago ! Businesses suffer from difficult, late and more expensive deliveries. Public transportation schedules are badly disrupted with the reduced speed of its vehicles on clogged arteries. Saturated roads lead to a worsening air pollution, a wasteful use of rarefying petroleum-based fuels, and unbearable crowding in buses during long commutes slowed downed by the volume of road traffic, and many other unpleasant conditions and experiences. Traffic jams also seem to heighten the risk of heart attacks[3].

According to a WHO study[4], 1,2 million people every year die in traffic accidents, many of them pedestrians and 2 or 3-wheeler victims, more than 70% in a number of East and Southeast Asian countries, the highest rate being observed in Thailand (81%). Road traffic injuries are now the world's leading cause of death for teenagers and young adults aged 15-29, and the second leading cause for children 5-14 years of age. The main reasons for this high level of road traffic injuries in developing countries are: the rapid growth in the numbers of motor vehicles; a higher number of people killed or injured per crash in low-income

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1 Latest statistics from National Bureau of Statistics of China, February 26, 2009, http://www.stats.gov.cn

2 At the same time, paradoxically, technological progress, either high-speed trains in Europe or airplanes in the United States, vastly reduces the time spent to travel between distant cities. But the time needed to get to an airport from the city centre is sometimes more than the time needed for the actual flight !

3 Traffic exposure may have a triggering effect on heart attack, http://americanheart.mediaroom.com/index.php?s=43&item=690

4 World Health Organization (2009) - Global status report on road safety, June 15, 2009, 301 p. http://www.who.int/mediacentre/news/releases/2009/road_safety_report_20090615/en/index.html

countries, a poor enforcement of traffic safety regulations, the consequences of accidents being often worsened by the unavailability of rescue teams in a timely manner and the inadequacy of health infrastructures.

Building road infrastructures, installing and maintaining traffic control systems, training new and young drivers, as well as educating pedestrian and bicyclists not used to heavy vehicle traffic, taming the « road rage » of aggressive drivers, all of these endeavors take time and money. Few cities in developing countries have underground transportation, therefore all traffic is on streets, and that means congestion. Even a new subway has not really relieved the congestion on Cairo's roads.

2. Congestion remediating in Western cities

Urban transportation issues in recent years have focused on sustainability and social issues (Newman & Kenworthy 1999, Vasconcellos 2001, Litman 2003, Deka 2004, Litman & Burwell 2006). Beyond the efficiency of the transportation system in fragmented and polycentric metropolitan areas, how can mobility be adequately realized without generating high environmental costs ? Are compact, dense cities more desirable than sprawling ones in the context of peak oil ? Is the shape of the city a factor in the generation of traffic jams and traffic-borne air pollution ? (Lyon, Kenworthy & Newman 1990, Jenks & Burgess 2001, Kaji 2003, Mindali, Raveh & Salomon 2004).

Also, who benefits from better mobility ? In many developing countries, the contrast is striking between people able to afford individual means of transportation, and poorer segments of society, condemned to walking or to use overcrowded and slow-moving public transportation. In the United States, social scientists have examined the problem of spatial mismatch, when jobs are now growing in « edge cities » located away from the residential areas of poorer workforce members, unable to reach the potential job providers (Cervero 2002), for lack of individual motorization and failure of public transportation system to adequately serve these new job centers. In France, urban sprawl has created a new category of left-behind citizens, those who can't afford a car to travel to services, jobs and shops from their homes in exurban areas (Coutard, Dupuy & Fol 2002, Rougé 2005, Motte-Baumvol 2007). Is the dependency on cars too high (Dupuy 1999, Héran 2001), even in European cities, where public transportation has remained a good alternative to cars ? (Newman & Kenworthy 1989, Kenworthy & Laube 1996, 1999). Does it create social inequalities between motorized and non-motorized citizens ? Are there gender-based (Blumenberg 2004, Blumenberg & Manville 2004), age-based, and ability-based differences ? On the contrary, can a policy of public transportation give better access to job opportunities to those who were deprived of it because of their lower level of motorization ? (Holzer, Quigley & Raphael 2001). Is urban mobility therefore only a technical or economic question, or does it contain cultural values reflecting society in the way people move around and live in the city ? (Amar 2004)

Problems of urban congestion have appeared early in Western nations, due to their antecedence in the development of an automobile-based mode of mobility. In fact, well before the advent of the automobile, large cities were already suffering from chronic circulation congestion. France is a good example. Inextricable and labyrinthine networks of small streets encumbered with shops, anarchistic circulation of horse-drawn carriages trying to cut through herds of cows and crowds of undisciplined pedestrians were already denounced by writer and polemist Nicolas Boileau in his 1666 poem « Les Embarras de Paris ». In the second half of the 19th century, the huge urban projects launched by Baron Haussmann in Paris allowed for the creation of the wide boulevards and avenues that give the French capital its current allure and provided several decades of relief for the circulation of horse-drawn buses and streetcars.

This was before the growth in the number of automobiles slowly overwhelmed the capacity of the streets to handle all the traffic, despite the construction of the underground Paris metro[5]. In Provincial French cities, municipal regulations regulated very early the passage of cars, that had to be driven at very slow speed thru town, preceded by a walking man warning pedestrians with a red flag. Despite a national decree of 1899 regulating the conditions of car traffic in cities, many mayors tried to prevent the development of automobiles by imposing heavy fees on the consumption of gasoline products through towns. The 1920's were a watershed time with the final acceptance of the automobile leading to the decline of streetcars and tramways and finally their disappearance (Flonneau 2003, 2007), and the subsequent rapid development of traffic jams in cities with narrow streets not designed for large vehicles. Obviously, the same Paris urban space cannot handle the automobile the same way in 2000 (4 million cars today) as it did in 1900 (2000 cars). In the 1960's, when basically every French household owned a car, the development of circular highways and

[5] A mostly underground Metro, with a few segments aboveground.

bypasses around cities was an effort to remove from city streets vehicles that were just going to and from places other than the city itself.

A first set of policies consisted in adapting the city to the needs of the automobile (Flonneau 2006 b), even if it meant abdicating the rights of pedestrians and non-motorized vehicles. In Paris, the first traffic circle was established in 1907 on Place de l'Étoile, giving the entire street space to the cars and rejecting pedestrians to the outside of the circle. In 1937, as a response to the exceptional flow of vehicles from all of France and even neighboring countries for the « Exposition Universelle », municipal authorities allowed parking on some sidewalks. Pedestrians were therefore limited in their rights to the city, as priority was clearly given to the automobile. It was even more obvious in post-World War II years, with the construction of urban freeways cutting enormous swaths through cities, doing irreparable harm to the neighborhoods they passed through and over (Di Mento 2009), and the development of large parking lots. American urbanization, especially in the Western part of the United States, has made widespread use of this approach, hence the freeway systems in Los Angeles or Houston and the huge amount of parking pavement easily observed in cities such as Phoenix or Las Vegas. Many local governments saw the freeways an answer to urban transportation problems. New roads, they believed, would increase economic growth. The construction of Interstate Highway System in the 1950's and 1960's also included Beltway rings around major metropolitan areas, at the edge of the then-urbanized area, as well as freeways reaching into the heart of cities. France also embarked on this policy during the 1960's and 1970's, when Prime Minister, then President, Georges Pompidou pushed for the establishment of shoreline auto boulevards alongside the banks of the Seine ("voies sur berges") in the very heart of Paris (Flonneau 2006 a). In France's second city, Lyon, a major national freeway cuts to the very heart of the city, creating a massive and noisy eyesore at the entrance of the Lyon-Perrache train station and alongside the right bank of the Rhône River.

However, resistance to urban freeway projects grew in the United States, both in minority neighborhoods severely impacted by construction, and in well-to-do neighborhoods where "Nimby" attitudes started to develop. For instance, when Arizona state officials planned to run I-10 through the middle of downtown Phoenix, they designed a stack of access and exit ramps. Locals opposed the design and, in 1973, voted to stop the road's construction. Community groups successfully protested a proposed interstate that would have taken traffic through Washington, D.C.. Similar movements stopped the planned « radiale Vercingétorix » from butchering the 14th arrondissement of Paris, as the ecological movement was taking root in Western Europe, especially in Germany, Scandinavia and the Netherlands.

Concerns with air quality and the noise generated by automobiles, as well as the implementation of the Kyoto principles, have led to a revision of the place cars must have in the daily life of citizens in large and small cities. There is a need to "civilize the automobile" (Doulet & Flonneau 2003). In many places it has been understood that it is not the purpose of city centers to attract cars, but rather to attract residents, shoppers and visitors for commercial, cultural or leisure activities. Cars use more space than any other means of transportation, whether they are in motion or parked--if there is space to park ! Concentration of activities in a small urban space imposes strict limits on access in order to preserve a peaceful environment, therefore policies now tend to restrict the flow of cars and the very use of automobiles, in order to retain the attractiveness of city centers. Well-known solutions have been applied, such as reducing on-road parking to a minimum, adopting plans that restrain traffic except for buses, trams and bicycles, and minimizing car access except for residents and limited deliveries, so that central areas, liberated from traffic jams and parking, become available again for walking, shopping, and leisure.

The most radical policy is to ban the automobile from the central areas of towns with the implementation of designated pedestrian districts (Monheim 1996, 2001). Many German cities that had been devastated by massive bombings during World War II rebuilt their centers with areas reserved for pedestrian travel and restricted access to motorized vehicles (still allowing shops to be supplied by small vans). Early examples can be found in Essen (Kettwiger Straße), Kassel (Treppenstraße) or Kiel (Holtenstraße). Stuttgart followed in 1953 with the first pedestrian area encompassing several streets. Outside Germany, Copenhagen and Amsterdam were among the early adopters of pedestrian areas. They appeared in France in 1971 in Rouen (Normandy) in the historical medieval district and have since spread to Strasbourg, Lyon, Dijon, Nancy, and a dozen other large cities over 100.000 people. In Italy, more than 60 cities have restricted access to their historic city centres except for buses and trams, for most of the day. In Rome this zone extends from the east of the Tiber to the Termini train station, encompassing the historical city centre, with its high density of employment, commerce and lodging.

It has been shown in California (Hansen & Huang 1997) that five years after a major freeway project is

completed, 95% of the new capacity fills up with traffic that would not have existed if the freeway had not been built. Building freeways to accommodate traffic would lead to more traffic, in an endless cycle of construction and congestion.

In reaction to this excessive encroachment of the automobile on urban living space, some cities who had given part of their best areas are now taking it back. Priorities have shifted away from enhancing mobility towards promoting livability.

Freeway « deconstruction » indicates a radical change in urban policy. One of the most famous examples of freeway removals deemed unnecessary (Newman 1995) and considered as eyesores, especially when they cut off waterfronts from the rest of the city is the Embarcadero freeway in San Francisco, but a number of other cities in North America have also experimented with that approach : New York City (West Side Highway), Portland, (Harbor Drive replaced by McCall Waterfront Park alongside the banks of the Willamette River), Milwaukee (Park East Freeway). Other cities such as Akron, Cleveland, Montreal, Nashville, Rochester, Trenton or Washington are also thinking about deconstructing some of their downtown and water's edge freeways. The goal is to give back the city to its citizens and contribute to urban regeneration (Cervero 2006a). In Louisville, this is also a possibility, but a major freeway interchange (I 64 - I 65) alongside the Ohio River will make the proposal extremely costly. In Paris, France, the Socialists and Greens municipal administration of Mayor Bertrand Delanoe has decided to close parts of the Seine's right bank freeway every summer for the Paris-Plage (« Paris Beach ») program, and on the left bank an entire portion has also been given back to pedestrian in the form of a new linear urban park with jogging and bicycling paths. The same policy of reclamation of urban waterfronts from the automobile has been applied in Lyon, where the entire left bank of the Rhone River has been reclaimed from parking lots and transformed into pedestrian areas, bicycling path and sports grounds (Gérardot 2004, 2007).

If the freeway is considered as essential, a major and very costly public works project, such as Boston's Central Artery/Tunnel and Corridor (the now infamous « Big Dig », Gelinas 2007), may bury it underground, allowing to develop new urban parks, sports facilities or playgrounds on top of the now buried freeway. This has the effect of raising land values (Tajima 2003) but the very cost of such projects may be a powerful deterrent, as shown in the cases of the Gardiner Expressway in Toronto, or the Alaska Way Viaduct in downtown Seattle, where plans to replace it with a tunnel have been put on hold (Garber 2009).

A softer version, when the freeway is not an elevated one, consists in covering open-air freeways, such as sections of the Boulevard Périphérique our Autoroute du Nord A 1 just North of the Paris limits. New freeways are built far away from the city center, so that non-metropolitan traffic does not interfere with local traffic. This is the reasoning behind the (difficult) building of « Autoroute A86 » around the Paris metropolitan area, to divert Spanish or Dutch truckers from the close-in Boulevard Périphérique, which was saturated almost from day one when it opened in the early 1960's. But of course it induces a strong risk of new sprawling on the outskirts of the urbanized area.

Making people pay more[6] to use their car on congested routes and in central cities (« pay-for-use », « selective road pricing ») is a method that many cities have embraced. Free parking is now very difficult to find in European cities except on weekends. Many « freeways » in the United States now include HOV lanes reserved for cars carrying at least 2 people (HOV-2) or 3 people (HOV-3) in an effort to popularize ridesharing and make life on the highway more difficult for lone drivers. Some areas[7] have gone a step further by implementing schemes of HOT lanes (High-Occupancy-Tollfree lanes), where single drivers have to pay a toll, when multiple-occupancy vehicles go free. This is also the case on the access bridges to San Francisco (Oakland Bay Bridge and Golden Gate Bridge).

In a number of countries, drivers can go through open area-freeway tolls without stopping, thanks to electronic collection devices and automated licence plate recognition sensors (Liber-T system in France, E-Z Pass tag in the Eastern United States, e-Tag device in Australia, Sem Parar-Via Facil in southern Brazil). In metropolitan areas such as Toronto, Santiago de Chile, Melbourne, Tel Aviv and Dubai, the system has been adapted for use on urban motorways.

Adapting tolls to central cities, and following the early lead of Singapore (see part IV), several European cities (London, Stockholm, Milan) have implemented elaborate congestion/road pricing schemes where drivers pay for using street space in the central city. Gantry-mounted cameras and sensors allow for electronic toll collection of entry fees into the designated zone.

German cities and Milan, Italy have established a system based more on the polluting potential of

6 In addition to high gasoline taxes in Europe, making fuel two or three times more exepnsive than in the United States

7 San Diego County and Orange County, CA, Denver, Minneapolis, Houston, Salt Lake City-Orem, Southern Florida

automobiles. With Milan's « Ecopass », polluting cars will pay to enter the central area of the city, but "clean" cars (fulfilling the "Euro 3" or "Euro 4" standards) may enter free. The system operates from 7.30 am to 7.30 pm during weekdays. The Ecopass is being policed by cameras installed at 43 electronic gates around a 8 square kilometer area around the Milan Duomo (Cathedral). Rates for polluting cars vary from 2 to 10 euros per day, a yearly pass goes for 50 to 250 euros, and fines for non-compliance amount to 75 to 285 euros. The objectives are to encourage people to use public transportation, to reduce traffic by at least 10% and to reduce air pollution by at least 30%.

In Germany, Low-Emission Zones (LEZ), or *Umweltzonen* (« environmental zones »), are banishing older, polluting passenger cars from many German cities after the pioneers Berlin, Cologne Hanover and Stuttgart. All cars entering an *Umweltzone* must display a sticker (*Feinstaubplakette*) in the windshield confirming that the car complies with the emission standards and is not emitting small particles with exhaust fumes. The basic requirements for *Feinstaubplaketten* are: Green stickers are for petrol driven cars (Euro 1 or better) first registered since 1993 and diesel vehicles registered since 2006 (Euro 4 or better). Yellow stickers are for diesel cars (Euro 3) first registered between 2001 and 2005. Red stickers are for diesel cars (Euro 2) first registered between 1997 and 2000. *Umweltzonen* are found mostly in major cities (Dortmund, Düsseldorf, Duisburg, Essen and Wuppertal in Rhine-Ruhr region, as well as Frankfurt, Mannheim, Karlsruhe, Ulm or Munich) but even small towns (Leonberg, Mühlacker, Pleidelsheim, Pforzheim, Rechlinghausen, Tübingen) have restriction zones[8]. However, the movement is much less developed in the former East Germany.

Another common way to deal with automobiles in cities without banning them is to give them a lower priority by encouraging the public to use other ways to move around : public transportation (buses, metros, tramways, monorails), water transportation and commuting in cities endowed with major water bodies, bicycling and walking. These alternate modes of transportation are considered as essential in the quest for a reorganization of the city around principles of sustainability at the heart of the "New Urbanism".

Subways have long been used for mass transportation in the largest cities, starting in London in 1863. European underground railways multiplied after 1890 with the harnessing of electric power: Budapest (1896), Paris (1900), Berlin's U-Bahn (1902), Hamburg (1912), Madrid (1919), Barcelona (1924). In North America, New York City's elevated metro was supplemented by a first underground line as early as 1890. In Latin America, the prosperity of Argentina in the early part of the 20th century allowed Buenos Aires to inaugurate its subway metro as early as 1913, at the time it had become the first million-people city of the continent. As their population grew, cities of 1 million or more spent the money necessary to carry a large numbers of travelers on routes serving the busiest spots in urban areas: train stations, densely populated neighborhoods, universities, business centers, and metro systems have spread to dozens of cities in Europe and North America. In the Soviet Union, Moscow's subway (1935) became the pride of the regime, beautified by stations with artwork and efforts were made to provide mass transportation at low cost for passengers in the context of a socio-economic system that strongly discouraged the use of private cars until 1991. In France, Lyon, Marseille, Lille, Toulouse and Rennes have built metro systems. So have Washington, Atlanta, Baltimore, San Francisco, and recently Los Angeles, in the United States. But the construction cost is too high and the volume of passenger traffic to make it economically viable is not sufficient in cities under 1 million people.

Buses are a dominant form of public transportation in many cities around the world, in addition to heavy-rail for the largest metropolises. The quality of the service provided is quite different from country to country and from city to city. London's famous red double-deckers and Paris' buses, some of them long articulated vehicles, cover these cities with intricate routes and high frequency, but Los Angeles' bus service is at best considered as poor. Efforts are underway to improve the reliability of bus service by implementing measures such as dedicated bus lanes, and more recently GPS on-the-spot information giving passengers exact information on the timing of buses approaching. In Latin America, Curitiba (Brazil) and Bogota, later on Merida (Venezuela), Leon, Mexico City, Guadalajara and Monterey (Mexico), Pereira (Colombia), Quito and Guayaquil (Ecuador), Santiago de Chile, and in the near future Lima and Caracas, have given their full attention to high-frequency buses on dedicated routes, under the generic term BRT (Bus Rapid Transit), such as Bogota's Transmilenio. In this system, buses basically become "subways on streets", with high capacity on huge bi-articulated buses (capacity 270 passengers in Curitiba's *Rede Integrada de Transporte*). Many European cities are looking at the system, such as Nantes (France), or at least considering some aspects of it. In a 250.000 people city such as Dijon, France, 7 routes have been designated "Lianes" (Lignes À Niveau

[8] See interactive map at : http://gis.uba.de/website/umweltzonen/index.htm

Élevé de Service), with buses running every 5 minutes, with longer hours of service, while buses on 15 other routes run at longer intervals of 15 or 20 minutes. Calgary, Montreal, Ottawa and Vancouver in Canada, Albuquerque, Boston, Chicago, Denver, Los Angeles, Minneapolis in the United States, as well as Sydney in Australia have launched BRT services, mainly with buses running on freeway lanes and some dedicated lanes on city streets to speed up travel on a few routes. In Adelaide, Australia, the unique O-Bahn Busway system allows city buses to follow rail-guided tracks on part of their route, therefore becoming part-time light-rail vehicles.

Streetcars, once a main element of urban mobility and an essential factor in the growth of pre-automobile suburbia (Warner 1978, Stilgoe 1989, Laconte 2004), especially with the use of electricity after the 1880's, had all but disappeared in the 1930's in several countries, including France, the U.K. and the United States, even though they remained a major part of transit systems in central Europe. But today, the United States and France are now striking examples of the rebirth of streetcars (Dobias 1998, Priemus & Konings 2001, Hattori 2004, Laconte 2004, Boquet 2007a, 2007b, 2008a, 2008b), starting in the 1980's and accelerating in the early years of the current millennium. Twenty years ago, only 3 cities in France (St Etienne, Marseilles and Lille) still had trams, and each retained only one line. But many French cities have now found that they can increase their attractiveness and improve their transportation sustainability by building a modern tramway system They were first reintroduced in Nantes, Grenoble, Strasbourg, followed by Paris, Rouen, Montpellier, Lyon, Clermont Ferrand, Orléans, Nice, Bordeaux, Nancy Existing tram networks are being extended and new ones are being planned (Dijon, Brest).

New routes are not as numerous as they used to, but the sleek and sometimes colorful design of new vehicles, their quiet ride, their comfort of access for elderly people and parents with baby strollers, have contributed to make them a powerful element of urban promotion as vectors of an image of modernity and ecology. Financing has been provided partly by the "*versement transports*" (transport levy), a tax paid by employers and used for investment in and the operation of collective passenger transport. In addition, French national urban Policies require that urban areas develop Urban Mobility Plans (PDU, "*plans de déplacement urbains*") taking into account not only the topics of accessibility and social justice in transportation opportunities, but also the dimension of sustainability, under the umbrella of "Local Agenda 21". Electric-powered streetcars/tramways are the instrument of choice, even if efforts have been made to reduce the pollution of regular buses (introduction of natural gas powered vehicles). The return of streetcar implies months of roadwork in central cities, and sometimes a complete reshuffling of bus routes.

In Germany, where trams had not disappeared as in France, an deliberate effort has been made to link as smoothly as possible intra-urban and inter-urban transportation, with the concept of « Tram-train ». Trams can be run on the same railway lines used for regional services, linking the city center with the outer city region. Passengers benefit from a fast rail journey and continue into the center, without changing modes. The need for cars is greatly diminished. The pioneering examples of Karlsruhe and Saarbrücken (Voskuhl 1995, Van der Bijl 1998) show that connecting urban trams and regional railways is an excellent way to increase the accessibility of cities.

French train stations are regaining a place of choice as « pôles de déplacements plurimodaux » (multimodal transfer centers) under a big push of French railroads SNCF to make them attractive places to shop, and convenient places to hop from high-speed TGV trains to city transportation, either tramways, buses or bicycle rentals. In Denver, Colorado, a good part of the urban revitalization strategy revolves around the rebirth of Union Station, with a new gentrified neighborhood of shops and restaurants replacing old warehouses, and the station plaza being a major node of transfer between the 16th Street free shuttle, the light rail network and regional trains.

Not everybody lives a short walk from a station, therefore private cars remain essential feeders to transit stations for residents of single-housing developments. To complement parking restrictions in city centers, there is a need for suburban « Park & Ride » facilities, such as the huge parking structures in end stations of the Boston or Washington metro systems. Drop-off zones for car passengers have also been set up near the entrance of train stations, both in the suburbs and in central cities, under the prosaic name of « dépose-minute » in France and the more romantic « kiss-and-ride » in the United States.

« New Urbanism » (Calthorpe & Van der Ryn 1991, Calthorpe & Fulton 2000, Calthorpe 2005), « Smart growth » and T.O.D. (transit-oriented development) policies aim at reconnecting transport with land use (Dunphy & Cervero 2005, Cervero, Filion & McSpurren 2007) and in particular to establish higher-density, mixed-use areas (Cervero & Duncan 2006) built around high-quality transit systems (Cervero 1998), providing a networked and multi-centered urban structure that can help to reduce sprawl and automobile dependence. Some of the best-known cases are

Toronto and Vancouver (Canada), Portland, OR and Denver, CO (USA), Freiburg (Germany), Copenhagen (Denmark) and Zürich (Switzerland). (Newman & Kenworthy 1996, Boquet 2009a). The goal is to get people out of their cars by providing easy access to public transportation, especially streetcars and subways, allowing them to reach major places of work and entertainment, while limiting the use of automobile for menial chores such as grocery shopping or administrative services. Cars are to be used only when other means of transportation as not adequate. New urbanism and TOD call for a mix of transportation solutions, including walking and cycling, all for the benefit of the city's environment and its residents' health.

For short distances, within a set of policies for new « green », « soft », urban mobility, bicycle use is strongly encouraged in Europe. Dutch residents are famous for their use of bicycles in Amsterdam or The Hague, and in recent years French cites have been very active in promoting bicycle use. Paris has launched, following the early lead of other cities such as La Rochelle, Rennes and Lyon, a hugely successful program of bicycle rentals, dubbed "Vélib", in association with the JC Decaux advertising company. Now at least 20 cities in France have their own version, with bicycle stations all around the central part of town: "Vélov" in Lyon, "Vélam" in Amiens, "Vélodi" in Dijon, "Vélo+" in Orléans[9]. Germany has set in place the concept of *Fahrradstraßen*, where bicycles have absolute priority over cars. Much of urban travel is in fact "bike-sized": 40 percent of all trips in the United States (and 50 percent in Britain) are 2 miles or shorter. More than 25 percent of all trips are under a mile in the United States. Cycling could eliminate most of these short, air-polluting trips[10]. Cities are now aiming to « green » themselves and become as « bicycle-friendly » as Amsterdam, Boulder (Colorado) or Ottawa (Ontario).

Experimental schemes aim at a peaceful coexistence between citizens of all ages and drivers. Hence the "shared spaces" (*gemeinsam genutzter Raum*) (Herngreen 2006, Hamilton-Baillie 2008), "slow neighborhoods, "traffic calming areas" (*Verkehrsberuhigungszonen*), "encounter zones" (*Begegnungszonen*) or "living streets" (*Woonerf*) existing in Germany, Switzerland or the Netherlands, promoted by the European Union and now appearing in France, where cars are limited to 30 kilometers par hour - even 20 km/h - in residential neighborhoods or busy pedestrian areas downtown. Street signs, speed humps, chicanes, sidewalk widening, pedestrian islands, barriers are among the devices used to ensure a slow speed of the automobiles, so that children may play safely in the street. It comes of course with campaigns extolling the civic virtues of motorist's respect for pedestrians and cyclists.

It is clear that Western nations and cities have tried to tackle the issues of congestion, air quality and accessibility for all. Policies have all aimed at reducing the flow of cars in cities streets, not always very successfully, but with an energetic effort from the authorities, not only in Europe, but also in Latin America and more and more in North American cities, local governments acting often against the policies, or lack of policies, of the federal governments in Canada and the United States (Boquet 2005, Lagarec 2009).

It is within this context that we shall present the specificities of circulation within large Asian cities and consider if traffic remediation policies experimented in other parts of the world can be applied successfully in Asian metropolises.

3. Asian cities : high density, rapid growth and heavy congestion

It took about 80 years for Europe and 60 years in the United States to raise the urbanization rate from 20% to 50% of total population, while in the case of Asian countries the corresponding periods were much shorter in Asia countries in the 20th century. For example, Japan, Malaysia, Indonesia and Korea took 42, 40, 32 and 25 years respectively for the same level of increase in the urbanization rate (Morichi 2005). In one generation, from the early 1960's to the late 1980's, South Korea transformed itself from the « land of morning calm » (75% rural population) to a newly industrialized country (75% urban population) dominated by a major metropolis - Seoul-Inchon - of more than 15 million people. Overconcentration of people in capital cities is also quite visible in Thailand and the Philippines, where Bangkok and Manila dwarf all other cities with a impressive level of metropolitan primacy.

Not only are Asian cities growing fast, but they are also characterized by the highest population densities in the world, with the highest numbers being fund in Indian cities (Mumbai, Delhi), Chinese cities (Hong Kong, Shanghai), as well as Dhaka and Manila. Human conditions make circulation very difficult, much

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9 "Vélo" is a colloquial term used in French for bicycles.

10 It is commonly estimated that 90 percent of emissions in a 5-mile trip are generated in the first mile, before the engine warms up.

more indeed than in Western cities, especially in the United States and Australia with their emptying core and low-density suburban sprawl.

Rapid urbanization in Asia since 1970 has been somewhat different from that of the developed countries in the West, with the emergence of a specific settlement landscape of « desakota »[11] first described by Terry McGee & Ginsburg (McGee 1991, Ginsburg 1991, McGee & Wang 1992). Desakota regions, found in countries as different as Japan (Hebbert & Nakai 1988, Desbois & LeTourneau 1999), China (Sui & Zeng 2001, Xie, Yu, Bai & Xing 2006, Xu & al. 2007, Xie, Batty and Zhao 2007) or Indonesia (McGee 1991, Cairns 2002), are characterized by an mix of agricultural and non-agricultural activities often stretching alongside corridors between large city cores and across densely populated rice-cultivating areas, therefore challenging Western notions concerning the separation of urban processes from rural processes and the spatial uniqueness of the respective landscapes. In several countries like China after the establishment of village-based enterprises, these areas were favored locations for « rural » industries linked to global capitalism through subcontracting arrangements with international corporations. The result has been an increasing level of truck traffic between these areas and major industrial plants and export facilities (ports and airports). It is observed for instance in the Pearl River Delta of South China (where Shenzhen and Dongguan have become million-plus cities in less than 20 years), in the Lower Yanzgi River area, between Shanghai, Ningbo, Hangzhou, Suzhou and Nanjing), or in the Philippines between Manila and the major air facilities at Clark and Subic bay used by UPS and Federal Express. Local and national governments have built new roads, new freeways, new airports and new harbors, imposing on once-peaceful rural landscapes many factories, storage facilities, logistics centers, golf courses, shopping centers, gated communities for the rich and high-rise apartment buildings for the people relocated to the suburbs after huge slum clearances in downtown areas and the rise of fancy office towers reflecting the quest to world-city status by many Asian metropolises such as Shanghai (Boquet 2009). Meanwhile, the road systems are choking with traffic generated by all these activities in the peripheral and interstitial areas, where farmers have to fight to keep their land (Lin 2009). At the same time, the arrival of migrant workers from far-away provinces has increased the central cities populations, and the rise in income has pushed more and more private vehicles on the streets of older downtowns built before the age of the automobile.

Relative wealth has suddenly made car ownership possible in cities designed without cars in mind. In the late 20th century Asian cities, under the powerful influence of the North American cultural model, the car is seen as the most attractive of all goods to own. In most Asian countries, the growth in the number of cars per inhabitant has been much faster than the rise in GDP (Senbil, Zhang & Fujiwara 2007). Between 1980 and 2000, for instance, South Korea s GDP per capita grew by 240%, but the number of cars related to the total population jumped 2546% ! Same for China : GDP/capita +346%, passenger cars per thousand people + 1209%. Even in lower economic growth nations, the difference is startling : in the economically stagnant Philippines, GDP/capita remained flat (+1% in 20 years), but the number of cars per person doubled (+105%). In poorer nations such as Bangladesh or Pakistan, GDP growth was at 46% and 61% but growth in vehicles/capita reached 247% and 199%. In Cambodia, the rates were comparable (GDP + 40%, cars/capita +37%). However, two countries experienced an opposite trend, Malaysia (GDP + 113%, cars +64%, maybe because of a massive use of scooters and motorbikes), and the city-state of Singapore (GDP +155%, cars +51%).

Another specific aspect of motorization in Asian megacities is the higher level of motorcycle ownership and use. Motorized three-wheelers play an important role in the daily life and the contribute greatly to pollution in the cities of India or Indonesia, scooters and motorcycles are all over the streets of Vietnam and Malaysia. China is somewhat different in the sense that it mostly skipped the stage of motorized 2- wheelers to go directly from bicycles to automobiles.

Cities with the highest density of population per square kilometer are logically amongst the most congested, as is clearly demonstrated in a context of low motorization by the case of Dhaka, Bangladesh, with its inextricable traffic jams of rickshaws. As the overall population wealth increases, pedestrians, bicyclists, and motorized two- and three-wheelers (Indonesian *bajaj*, Thai *tuk-tuk*, Indian *chakdo*) have to share the road space with larger automobiles. Speeds are therefore very low. According to the UITP Base 2001, the average speed on the streets of Bangkok was only 15 km/h. It was 18 in Manila, 19 in Jakarta 20 in Shanghai, compared to 28 in London and 38 in New York City.

Compounding the problem in Asia is the generally limited amount of urban space devoted to road space. While Phoenix is using 30 % of its total area for automobile use (streets and parkings), Paris 25% and New

[11] A combination of two Bahasa Indonesian terms: « desa » for village, « kota » for town

York City 23%, numbers drop to very low levels in most Asian cities : Bangkok 12%, Xi'an 8%, Shanghai 7%, Hanoi 6%, Kolkata 6%, Pune 4%. Asian cities have therefore an extremely limited amount of road available per capita (in meters) : about 0,1 meter of street per resident in Hong Kong, Seoul or Jakarta, 0,2 in Surabaya, Bangkok or Tokyo, 0,3 in Singapore, when the rates are 0,4 in Paris, 0,5 in London, 1 in Washington DC, 1,1 in San Francisco and 1,7 in Denver (Barter 2000). There is clearly very inadequate road space in Asia megacities, and an American-style pattern of individual mobility development based on the dominance of the automobile cannot be sustained in the long- as well as the short-term (Hook & Replogle 1996).

East Asian megacities are facing rapid growth not only in car ownership level but also in usage of cars. Annual vehicle-km per car unit for Tokyo is now estimated at 8,850 km while the figures for Taipei, Seoul, Manila, and Beijing are 10350 km, 16013 km, 11509 km and 18300 km respectively (Acharya & Morichi 2007). Only Jakarta and Bangkok have figures below that of Tokyo as 7160 km and 6126 km respectively.

4. Transportation policies in Asian cities

The demand for cars is rising in many parts of Asia, placing national and local governments in a dilemma. They are anxious to promote local car manufacturing to create employment, reduce imports, and stimulate local components industries, with support from Japanese multinational corporations, and also Western car manufacturers in Thailand, China and now India. On the other hand the car is a major contributor to urban congestion and pollution. (Spencer & Madhavan 1989).

The first policy response to the automobile and motorbike tide is to let it rise and to try to cope with it through road building and other reactive measures. Among the most obvious examples are Bangkok, Taipei and Kuala Lumpur, which have embarked on an American-style of heavy car dependency (Barter 2004). But it led quickly to disastrous traffic conditions and a severe deterioration of the urban environment.

The opposite response, politically more difficult to achieve, is to restrain the use of private vehicles, somehow denying mobility to those who aspire to it, and encourage the alternatives by promoting public transportation (improve bus systems, build or expand urban rail networks). This strategy was generally adopted in the better-off countries and territories : Japan, Korea, Singapore, Hong Kong.

To accommodate this growing number of cars, cities have tried to increase the amount of road space available. Bangkok has filled many of its *khlong* waterways to turn them into streets, albeit prone to flooding during monsoon season. Following the early example of Tokyo, Shanghai has developed an elaborate network of elevated urban freeways. Profound alterations of the urban fabric in Chinese cities have allowed the creation of large boulevards, at the cost of massive demolition of the ancient *hutong* in Beijing and *lilong* in Shanghai, and the forced relocation of inner-city residents to faraway residential complexes in the suburbs. Manila and Jakarta are currently undergoing similar relocation of poor residents, causing criticism, petitions and protests, on the streets and on the Internet.

However, forcing the automobile unto the city fabric has proven to be a factor of social upheaval. China is currently struggling with farmers' complaints about eviction from their farms on the outer edges on large cities (Lin 2009), and citizens' movements start to develop against the massive encroachment of cars into residential neighborhoods. Expanding space for automobiles does not seem to be the best way to proceed in the Asian context of hyper-density.

Built before the 1964 Summer Olympics, the expressway above the Nihonbashi Creek in central Tokyo, hiding the famous Nihonbashi bridge and obscuring the classic view towards Mt Fuji, is now contested by citizens associations. They have petitioned to remove this expressway or bury it underground, supported by the national government, but facing opposition from the Tokyo local authorities, because of the cost estimated at 4 billion US dollars. In Seoul, the Cheonggyecheon Expressway has been dismantled and the river bed it covered has been transformed into a linear urban park, without causing massive disruptions to Seoul's overall patterns of circulation. The mood has now turned, as in Europe or North America, against the urban freeways. Therefore, other solutions should be looked at to reduce the need for car use.

Local authorities in many Asian cities now show commitment to the improvement of their environment (Dhakal & Lee 2005, Barter 2008, Morichi 2009). Municipal councils have implemented traffic management programs, such as banning cars with certain number plates on certain days (Manila's « Vehicular Volume Reduction Program ») or restricting the number of licenses available for motor vehicles, particularly scooters. Beijing policies advertise « green transportation », « social dimension » and « sustainable development » (Quan & Chen

2003). In many Asian countries, choked by air pollution, emission standards have been tightened much more than in the United States, so that a country like China can now be considered as a worldwide trendsetter for the emission level standards, due to the growing importance of its auto market. Vietnam's central authorities have put in place new vehicle tests for exhaust emissions, and in a parallel campaign against noise pollution, banned the use of horns after 8 pm.

Tiny Singapore has shown the way for automobile traffic control. After congestion pricing was briefly attempted in Hong Kong in 1983 (Pretty 1988, Hau 1990), it was really developed in Singapore, the world's trendsetter and laboratory in that domain (Foo 1997, Luk 1999, Foo 2000, Goh 2002, Phang & Tho 2004, Olszewski 2007).

Because of its rapid economic growth over the last 40 years and its limited land supply, Singapore had to pay close attention to the growth of private automobiles and has chosen to restrain car traffic demand. Demand management measures have focused on controlling the source of traffic congestion, with the government acting on both fronts : tight control over private automobile ownership thru the Vehicle Quota Scheme (Chin & Smith 1997, Koh 2003), and regulations on car use within the Central Business District.

Facing traffic congestion in the Central Business District, Singapore decided in 1975 to implement the « Area Licensing Scheme », a manned system of tolls for multiple entries into the « Restricted Zone ». This early policy was effective in cutting down the volume of vehicular traffic in the central area, but the problem of congestion merely shifted in time and place. Several changes were made to the plan, such as « shoulder pricing » (reduced tolls before and after the peak period) to even out traffic flows in 1994, and the « Weekend Car Scheme » (1991) and « Off Peak Car Scheme » (1994) to encourage people to use the roads during off-peak hours. The « Road Pricing Scheme » was introduced in 1995 on a congested highway to familiarize the public with linear passage tolls.

Finally, in 1998, Singapore discarded its early system of road tolls in favor of « Electronic Road Pricing ». Under the ERP system, charges for entering the city center and using some expressways are deducted automatically from a rechargeable account. Overhead gantries register electronically the identity of the vehicle. Charges fluctuate during the day in order to maintain traffic speeds within the desirable bands. Studies have shown that demand elasticity with respect to pricing is higher for cars than for other vehicles and higher for expressways than for the city centre cordon. It is also lower in the morning peak and higher in the afternoon (Olszewski & Xie 2005). On a wider perspective, the motorization restraints, coupled with the development of an efficient public transportation system and a determined land-use planning, did not exert any significant negative side-effect on the economic growth of the territory and generated substantial funds for the improvement of social welfare. Singapore, free from major car congestion, maintains the car share of work trips below 25%, travel speeds are satisfactory, the air quality is better than in other cities and Singapore's urban transport energy usage quite low (Pacudan 1997).

Although Singapore conditions are in many aspects unique, its travel demand experience can provide useful lessons for other rapidly growing cities in Asia. It has been able to de-couple urban mobility needs from environmental degradation, and has demonstrated that rapid urban and economic growth does not have to bring traffic congestion and pollution (Chin 1996). It now serves as the model for the implementation of congestion pricing schemes around the world, including for other Asian cities. However, the strong governement management system of the country, with effective coordination between agencies and the early layout of rules and regulations, may not be easy to replicate in other countries with much larger populations and a higher degree of social inequalities.

Nevertheless, Seoul has also started to charge tolls in downtown tunnels and urban expressways (Kim & Hwang 2005). Shanghai, Nanjing, Kuala Lumpur and Jakarta are now looking closely at the possibility of implementing a Singapore- or London-style congestion charge district.

Shanghai has established in 1998 a quota for new car registrations (limited to 50.000 per year). Car registrations are publicly auctioned at costs reaching 5000 US dollars. Parking space has been limited, getting a drivers license is difficult, and the city is pushing the use of taxicabs, with the secondary benefit of providing an outlet for Shanghai-built Volkswagen Santanas, who make up the immense majority of the taxi fleet. Strict requirements have been imposed on private taxi companies, in terms of cleanliness and service, in order to make using cabs a pleasant experience for the passengers, while limiting the number of cars on the street and therefore avoiding somewhat the plight of Beijing's horrendous traffic jams and pollution.

Is it possible in Asian countries to turn away from the automobile and embrace softer and greener modes of transportation ? Public transit use share of urban mobility differs greatly from one Asian city to another. When masses of Indian commuters use public transportation (overcrowded and aging trains and buses) in Mumbai (81% of trips according to UITP 2001 data), 91% of Kuala Lumpur residents use individual means

of transportation: two-wheelers and automobiles. The modal split was about even in Tokyo, Bangkok and Jakarta, and was leaning 2-to-1 in favor in public transportation in Shanghai, when it was, as a comparison, about 3-to-1 for automobiles in London and Paris, and 9-to-1 in Greater New York.

People seem to drive more in developing Asian countries than in richer Japan, possibly because Tokyo has developed since 1927 a powerful subway network complementing the suburban railroads started in the late 19th century. Train stations dotting the Tokyo landscape are now the major hubs of activity in the Japanese capital city, where private railroad companies were able to play an essential role in the shaping of the city. (Aveline, 2002, 2003). Greater Tokyo residents may stoically endure packed trains and subways at rush-hour, but outdated streetcars in Kolkata are probably not fulfilling the wishes of West Bengal s citizens for daily commutes.

Is it possible to use the example of French and American cities to revive tramways ? It is quite interesting to note that except in Japan, where 15 cities run streetcar or light-rail systems, this form of urban transportation is not as popular as in France or the United States. Kolkata trams, starting in 1902, are the oldest system in Asia, but they are quite outdated and remain stuck in traffic like any other mode of transportation. No other Indian city runs trams or LRT. Most cities which used to run trams dismantled them after WW2 : Mumbai, Delhi, Chennai and Kanpur in India, Seoul and Busan in South Korea, Saigon (Ho Chi Minh) and Hanoi in Vietnam, Bangkok, Penang, Colombo, Manila. Few Asian cities in the past had streetcars, when American and European cities of all sizes ran them. Only a few Chinese cities have retained their old streetcars (Dalian, Changchun). And the return of the streetcars is very slow : except for Pyongyang, with no problems of congestion given the absence of private car ownership in North Korea and a limited expression of street life, only a handful of Chinese cities are starting new streetcars : Tianjin, Wuhan and Suzhou. It is not much in comparison to Western cities. It seems that the density of traffic and the lack of road space to insure adequate speeds and adherence to schedules is a major obstacle to the development of street-level mass transportation.

However, major urban transit projects to mitigate congestion and pollution have been undertaken in many Asian cities (Acharya & Morichi 2007). If light rail is very limited (Hong Kong and Manila), solutions are sought underground and above ground. Some cities are implementing a combination of light rail, rapid transit, and Automated Guideway Transit systems (Kuala Lumpur, Taipei, and Singapore). Many others are facing major strategic decisions regarding which type of transit technology to implement, from conventional subway systems to monorails and people movers.

Monorails and « elevated people movers » have found their way first as a fast way to get around amusement parks (Disneyland Monorail in 1959, followed later by Disneyworld Monorail, California Six Flags Magic Mountain, Lotte World and Taedok Science Town in South Korea, Europa Park in Germany, Chester Zoo in England, Sea World in Australia, Sentosa Express in Singapore) or through airports facilities (Newark, Tampa, Orlando, San Francisco, Düsseldorf). But they are now appearing as a new way to move around towns, either as downtown loops (Miami) or as elements of a new network of public urban transportation. If Europe, with the exception of the historic Wuppertal suspended monorail and one line in Moscow, has clearly preferred to embrace street-level tramways, American and East Asian cities, in opposite contexts of population density, are developing rapidly this new form of urban transit, at a cost lower than underground heavy rail. Currently, Jacksonville and Las Vegas are the only two cities in the United states operating monorails, but there are ambitious plans for intercity monorail traffic between Atlanta and Chattanooga, Baltimore and Washington, San Diego and Los Angeles.

Asian metropolitan areas are clearly in the lead worldwide for urban monorails. They can be found in several Japanese cities (Tokyo, Chiba, Fujisawa, Tama, Osaka, Hiroshima, Kitakyushu, Naha), in China (Chongqing, Shenzhen) as well as in Kuala Lumpur and Bangkok. Plans are underway in many more cities of China (Beijing, Shanghai), India (Delhi, Mumbai, Bangalore, Chennai, Kolkata), Malaysia (Johor Bahru, Malacca, Penang), South Korea (Seoul, Taegu), Pakistan (Lahore, Islamabad, Karachi) and Vietnam (Ho Chi Minh-Ville). Bangkok has a slightly different system with its BTS (Bangkok Transit System) « skytrain », in fact an elevated metro comparable to early lines in Chicago, New York or Paris. A major advantage of elevated transit systems is the ability to avoid street traffic and maintain speed and schedules. A drawback is the negative visual effect it may have on the street below, especially under rail stations, as is evident on Kuala Lumpur streets of with massive concrete structures akin to pillars of elevated freeways.

Underground mass transit operations, which can carry even more people, cost much more and are probably not advisable for « small » cities. But they are a top contender to meet the rapidly increasing travel demand in the largest Asian cities. Their viability and sustainability depend very much on accompanying transport policies and land development strategies. Projects must be planned with accompanying long-term transport policies, as was demonstrated successfully in Singapore and Hong Kong, where mass transit has

been effective in deterring car ownership (Cullinane 2002, 2003, Hong & Lo 2008). Today, 32 South and East Asian cities already operate subway systems, but until 1969, only Japan had metro systems (Tokyo 1927, Osaka 1933, Nagoya 1957). Then came the capitals of socialist countries (Beijing 1969, Pyongyang 1973) with some military strategies in the excavation of tunnels under the two cities. Other large Japanese cities (Sapporo, Yokohama, Kobe), as well as Hong Kong and Korea's Seoul, also opened their subway systems in the 1970's. Subways have spread in the last 25 years : Tianjin 1980, Fukuoka and Kyoto 1981, Kolkata 1984, Busan 1985, Singapore and Sendai 1987, Shanghai 1995, Kuala Lumpur and Taipei 1996, Chennai and Daegu 1997, Guangzhou and Inchon 1999, Delhi 2002, Dalian 2003, Bangkok, Kwangju and Shenzhen 2004, Nanjing 2005, Daejon 2006, Kaohsiung 2008. Chengdu is scheduled to start metro service in 2010.

Asia Pacific has been a hotbed of subway construction activity in recent years, with China being one of the most progressive countries in the region. Shanghai's and Beijing's plans are very ambitious, Tokyo runs the busiest metro system in the world, and Seoul has jumped, in two decades, to the world's third rank, just behind Moscow, way ahead of New York City and Paris. Beijing has passed London, and Shanghai will soon. But less advanced countries, such as Bangladesh, the Philippines or Indonesia have not embarked on the heavy costs of subway systems. Subways appear as an element of modernity for the cities of fast emerging countries in Asia, and quite often the adoption of new transport technology encompasses details such as the commuters use of smart cards with embedded chips for contactless payment of transit fares. Paris's « Navigo Pass », London's « Oyster card » and Washington's « Smarttrip » have their equivalents in Hong Kong's « Octopus Card », Singapore's « E-Z Link » and Beijing's « Yikatong ».

Suburban rail is also used in many countries as a means to carry as many people as possible from outlying areas to the central areas. Suburban trains are a major mode of commuting in Japanese and indian cities. In the Manila metropolitan area, the Northrail-Southrail Linkage Project aims to develop a modernized railway system linking Caloocan, north of the capital, to Calamba, south of Manila in Laguna province. Resembling somewhat Paris RER regional transit, it would serve the Makati CBD as well as downtown Manila, with plans for further expansion towards the Clark business zone in Angeles City in Pampanga province, 100 km north of Manila. It would provide a fast, reliable and affordable mass transport service, as an alternative to automobile commuting. But it is also a controversial project among the poorest citizens of the country, since the construction work has resulted in clearing operations and a massive relocation of informal settler families living in slum communities along the Northrail and Southrail tracks.

At a lower cost, an alternate strategy to increase the share of public transportation is to provide better bus transit, even though this popular mode of transportation is currently lacking in quality. Two ways are explored : bus rapid transit on dedicated lanes, and the use of small community vehicles. Investment in infrastructure is much more limited than for underground mass transit or elevated light rail/monorail, and therefore more applicable to countries and cities with fewer financial resources. Bus systems cost can also be carried by the private sector

A number of Asian cities have seen the success of Bus Rapid Transit systems in Latin America, and are now promoting their local versions of BRT. Several Japanese cities are using the concept. Bogota's Transmilenio is the model for the « Transjakarta » BRT launched in 2004. With the support of its sister city of Zurich (Switzerland), Kunming published a new master plan and introduced the first Chinese BRT in 1999, followed by Beijing and Shanghai (2005), Hangzhou (2006), Dalian (2007), Changzhou and Xiamen (2008). Plans are underway in Chengdu, Chongqing, Guangzhou, Huai'an, Jinan, Shenyang, Shenzhen, Tianjin, Wuhan, Wuxi and Xi'an. This will probably make China the world leader in adoption of BRT schemes. Other countries are also actively planning for BRT, such as Indonesia (Bandung, Batam, Bogor, Makassar, Pekanbaru, Surabaya, Surakarta, Yogyakarta) or India (Ahmedabad, Bangalore, Bhopal, Chennai, Indore, Jaipur, Mumbai, Mysore, Surat, Visakhapatnam) after the pioneers Delhi and Pune. So have Cebu, Manila and Makati in the Philippines. Even Dhaka, possibly the most congested city in the world, has started to evaluate the potential of BRT to get out of its transit predicaments.

The second approach to a better bus service is to use smaller vehicles, not necessarily on fixed routes. Shanghai, for instance, has authorized private entrepreneurs to offer service, at a higher cost, but of better quality (comfort, speed, noise and pollutant emissions), in addition to the municipal buses plying traditional routes with multiple stops. The implementation of BRT lanes will allow both public buses and private vans to provide a more efficient service. In Beijing, corporations and governmental entities are encouraged to provide collective transportation for commuters to reduce the number of cars on the street system of the Chinese capital. Informal service exists already in many countries, such as the Manila *jeepneys*, Jakarta's *mikrolets* or Bangkok's *silorleks*. But governments have found difficult (Cervero & Golub 2007) to integrate these systems, run by a myriad of small entrepreneurs, often at the edge of safety regulations, into their mobility

plans. The trend has been in favor of massive government-sponsored projects and the introduction of systems run by subsidiaries of international corporations such as France's Veolia Transport (renovated bus system in Hanoi, Vietnam) providing ready-to-use solutions with management under joint-venture formulas. Homegrown, small size operations, are not looked on favorably by most urban governements. While providing on-demand mobility for the transit-dependent, jobs for low-skilled workers, and service coverage in areas without formal transit, they also increase traffic congestion, air and noise pollution (especially the omnipresent *bajaj* and *tuk-tuk*).

If Asian cities are to follow the examples of European « green » transportation policies, they must give back their place to pedestrian and cyclists in the city.

Singapore and Japan authorities have basically ignored bicycles in their transport plans. While many municipal authorities across Asia were spurning the lowly bicycle, as not modern enough, millions of Asian urbanites continued to use it and were prepared to fight for its place. In China, when the Mayor of Guangzhou tried to ban cycles from 11 of the city's main streets, following Beijing's example of closing Chang An Jie to non-motorized vehicles, public outcry was so great that the idea had to be scrapped. In Jakarta, cyclists mounted their own Critical Mass rides in a campaign for better facilities, and in Bangkok, the Thailand Cycling Club launched a campaign for bicycle lanes. Now, bicycles seem to be looked at more favorably by local authorities, especially in Chinese cities (Doulet 2009, Yuan 2009).

After a difficult start in the early 2000's, bicycle rentals are growing in contemporary China, maybe after the success of bicycle policies in Europe. A number of large avenues have been separated into car-lanes and bicycle lanes, even if the crossing of major intersections remains a perilous exercise for cyclists, young and old. In an effort to demonstrate its interest for « green mobility » (*lüse chuxing*), the Beijing government is now encouraging private implementation of bicycle rental schemes, such as on the Qinghua and Beida university campuses (I-Bike Media Company). I-Bike Media Company is also launching service in Shanghai and Wuhan. Just before the 2008 Olympics, Fortune Bicycle Company launched its service that may include up to 25000 bicycles and 1000 bicycles stations throughout Beijing. The company is working on the preparation of a map showing the locations of rental/drop-off points. Hangzhou has developed a system that resembles closely the French system popularized in Paris by Decaux Vélib, with a cooperation between the Hangzhou Public Transport Cooperation and Hangzhou Public Traffic Advertising Co.

In March 2009, Kaohsiung launched its first self-service bicycle rental system, with 1,500 bikes available for rent at 20 transit points around the city, operated by Tung Li Development Co. In Taipei, at the same time, the city's « You Bike » effort started with a fleet of Giant-manufactured bicycles available at bicycle parking meters in five areas around the city. Sponsored in part by Cardiff Assurance Vie and its parent company, French-based BNP Paribas Group, the YouBike Public Bicycle System uses the city's EasyCard as its membership card. Google Maps technology on the YouBike web site allows users to check availability in advance. Taipei is also doing a lot in terms of bike lanes, maps and allowing bikes on the metro and a similar program was recently started in Changwon, Korea. Some Seoul districts already run free bike sharing, though a citywide program is not yet in place. Such programs are put in place on university campuses in Indonesia.

A special place must be left here for a mainstay of transportation in South Asia, the rickshaw. The first affordable alternative to walking in Asian cities arrived in the late 19th century when hand-pulled rickshaws began to appear. Hand-pulled rickshaws pulled by a man and able to carry two passengers were invented in Japan in the 1860s (*jinrikisha*). They reached a peak around 1900 in Tokyo and in the 1920s in Hong Kong, Singapore, Kuala Lumpur and Bangkok before being replaced by pedicabs (*trishaw*, *pedal rickshaw*, *samlor*, *becak*, *cyclo*, *tricycle*) despite strong resistance from the rickshaw pullers, due to the lack of smooth, hard road surfaces and the high cost of imported bicycle parts. Probably invented in Europe not long after the bicycle, but never popular there, pedicabs were first introduced to Singapore in 1914 then appeared in Bangkok in 1933 and Jakarta in 1936. In the 1950s they existed in large numbers in many countries of South and Southeast Asia. However, by the 1960s, decision-makers viewed pedicabs in a negative light and their use began to be restricted. They were banned from Bangkok in 1961 and severely restricted in Singapore and Kuala Lumpur, then in Indonesia.

Now banned in Pakistan, they have remained prevalent in India and Bangladesh, where rickshaw pulling provides peasants with limited skills and education a relatively easy access to the urban labour market, and an escape from extreme rural poverty (Begum & Sen 2005). Today, however, rickshaw pulling is the target of policies aiming to ban them. In 2006 the High Court of Delhi ordered the municipal government to stop granting licenses for cycle rickshaws on Delhi roads, and to ban their use in Delhi's Chandni Chowk area, leading to a challenge in front of the Supreme Court of India in 2007. It was contended on behalf of

Initiative for Transportation & Development Programs (ITDP India) that the order to ban rickshaws was contrary to both the National Urban Transport Policy and the Master Plan of Delhi, both giving strong emphasis on non motorized transport. Banning the rickshaws would cause a transfer to more polluting transportation modes and create massive unemployment for the poorest of the citizens. Estimates indicate that an general ban on cycle rickshaws would put out of work 200.000 people in Delhi and maybe 2 million in all of India, while eliminating from the streets the cheapest mode of transportation other than walking.

Interestingly, pedicabs are gaining in popularity in European cities to provide a non-polluting way to visit the tourist sites, while providing interesting jobs for students. A modernized system of semi-electric motion eliminates the fatigue for the pedicab driver.

Pedestrians cannot be ignored in Asian cities (Mateo-Babiano & Ieda 2005). Many people in Asian cities move on foot, for lack of personal transportation equipment and lack of money for public transportation. Dense crowds in Chinese or Indian cities always exert a strong impression on first-time visitors. In fact, Asian streets are much more lively, especially at night, than in European or North American cities. Night markets and street restaurants contribute to the atmosphere of the street as public space, but encroach on road pavement, therefore hindering traffic, at all times of the day. Now, with the increasing affluence of Asian citizens, and the overcrowding of old downtowns sometimes aggravated by high crime rates, such as in Manila, wealthy shoppers and tourists are leaving urban markets for outlying, highway-side hypermarkets and multiplexes. Some cities fight back with new pedestrian zones offering a more environmentally-friendly, attractive alternative that improves the quality of life and generates economic development. Shanghai's Nanjing Road and Beijing's Wangfujing, have been turned into pedestrian streets on the model of German cities, both in a local context of hyperconsumption landscapes. Less developed than in Europe, the concept of the street only for pedestrians is slowly appearing, but at the same time the quiet pedestrian-sized neighborhoods of old Beijing and old Shanghai, which were in fact « encounter zones » before the Germans popularized the idea, have largely disappeared under the assault of bulldozers. Regaining the street for pedestrians is probably one of the major challenges of Asian cities.

Conclusion

Beyond obvious differences in terms of urban density and levels of economic development, urban mobility issues can be dealt with with the same approaches in Europe, North American and Asia. A common pattern of actions aiming to limit the exclusive use of the automobile as a means of urban transportation is visible. In Los Angeles, the epitome of the car-based city, despite its origin as a rail city in the early 20th century, a subway system and BRT routes have been put in place. Kuala Lumpur, possibly the most car-dependant of large Asian metropolises (Barter 2004), has developed both a subway and a monorail system. Las Vegas, another automobile city, built a monorail.

If some policies have been implemented first in Europe, Asian cities can also provide Western urban areas with innovative methods, as Singapore's congestion pricing has shown. Tokyo's impressive rail and subway network runs smoothly enough to insure adequate mobility to 30 million people. Today, Paris and the French government are planning new – albeit costly – routes for mass transit between suburbs, as a way to better serve an increasingly polycentric metropolis.

Most of the efforts in Asia have been concentrated on major metropolises, when Europe has seen much progress also in medium-size cities. Asia seems now to show some needed progress on secondary cities, which are also suffering from the same trends of congestion as world metropolises (Dimitriou 2006). The main challenge for these policies to succeed is to encourage a change in the habits of commuters, and to be able in lesser advances countries to make enough people aware of the needs to balance environmental issues with social issues for the sake of a more harmonious city where mobility is equally shared by all.

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