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Although ISOCARP members work in many different fields they share a common interest in the spatial and environmental dimensions of urbanisation. They advise key decision-makers, proposing and supporting projects for intervention in a spatial context through general or specific actions.

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ISOCARP REVIEW

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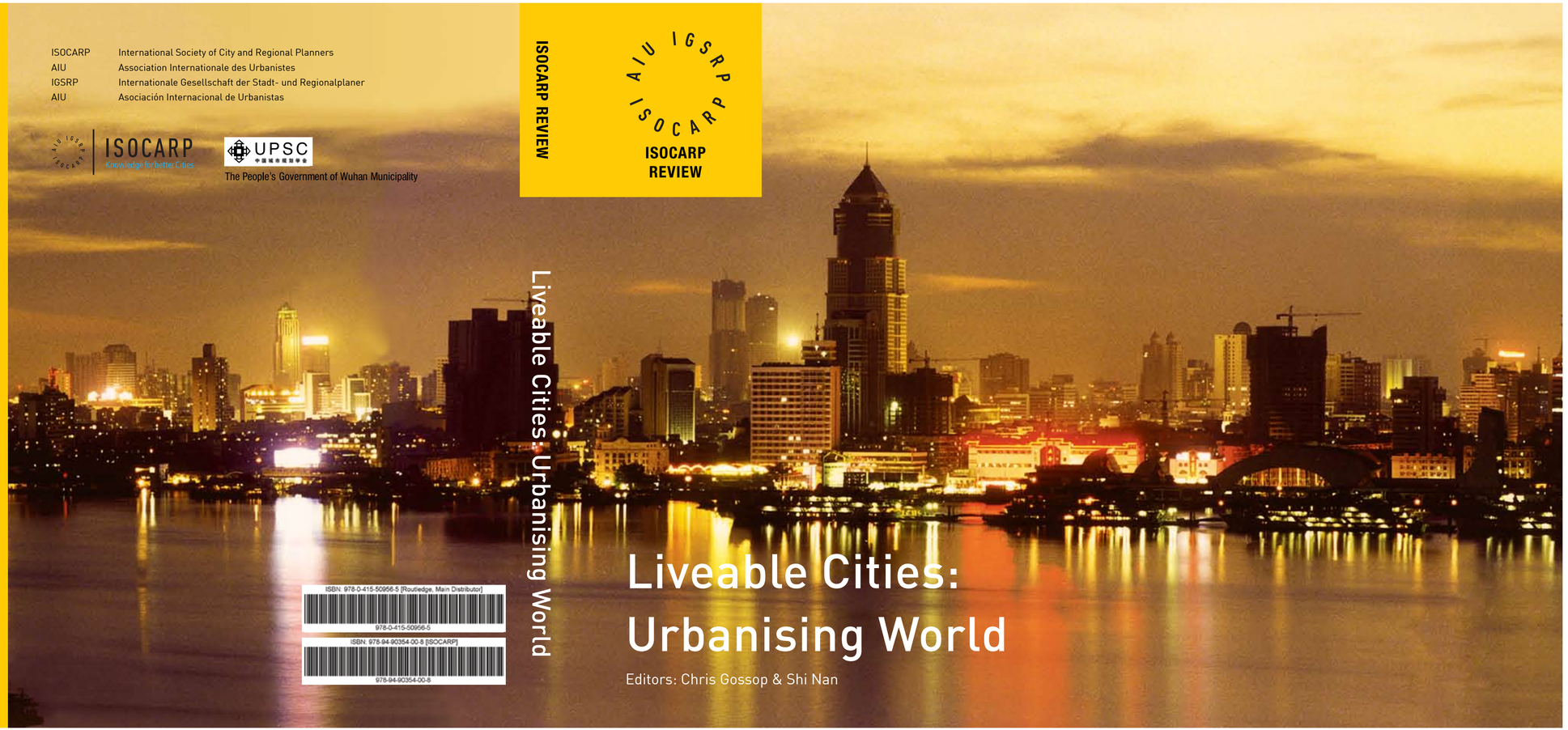
Liveable Cities: Urbanising World



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Liveable Cities: Urbanising World

Editors: Chris Gossop & Shi Nan

Contents

The Contribution of Mobility to Liveable Cities

Pierre Laconte

Introduction

Achieving sustainable cities includes social and economic as well as environmental factors that make cities attractive and liveable. What sorts of transport systems are appropriate for a sustainable city, seen from each of these points of view?
Achieving an integrated sustainable urban mobility concept could include some of the following components:

- Decoupling income progression from increase in energy use by citizens of a city and its region.
- Encouraging life styles favouring non motorised transport clusters all over the urban region, and reducing subsidies for fossil fuel, increasing the population density.
- Optimising the use of each transport mode and interconnecting transport modes. That means ensuring effective rail networks, networks of tram/bus rights-of-ways, convenient intermodal hubs, easy use of bicycles and availability of rented bicycles and of taxis.
- Assessing the health effects of a switch from motorised transport to non-motorised transport (walking and cycling).
- Implementing synergy between the supply of public transport and restraint on the use of the car in the city.

The paper includes examples of integrated sustainable mobility.

Mobility and Liveable Cities - Enjoyment as a Key to Liveability. Poster by Friedensreich Hundertwasser for UITP (1995)

Figure 1: View of Chicago in the 1930s, showing the street full of cars while the streetcars (trams) could no longer move, as they had no right of way even though they paid entirely for their infrastructure and its maintenance. Streetcar companies went bankrupt one after the other and public transport gradually left the realm of urban business services to enter the realm of public social services.

Transport and Mobility Planning - Post-War Trends and Consequences for Cities and Urban Dwellers

Trends

The post war era witnessed a shift in citizens' attitudes towards society in general and urban life in particular. French political scientist Marcel Gauchet has referred to this phenomenon as "mass individualism" (Gauchet, 1985).

Mass individualism is characterized by the increased consumption of positional goods – goods that position individuals in relation to others – notably freestanding, single-family houses and private cars.

This shift in consumer preferences found its origin in the United States. It was largely shaped through the common interests of three industrial sectors: the nascent automobile sector (which was championed by Henry Ford); the oil sector (whose market had practically disappeared following the replacement of petroleum lamps by electric lighting but was revived by the oil consuming automobile); and the various industries associated with highway construction and suburban development.

Together, these sectors became incomparably stronger – in political and economic terms –

than the large railway companies, which had been all-powerful in the late 19th century and the beginning of the 20th century. While the railways and tramway companies still had to finance their infrastructure, from that period, road infrastructure and maintenance were financed by the public sector and no longer by tolls or user charges as had been the case throughout history.

Therefore personal investment in cars was encouraged, not only by the lifestyle change resulting from increased household income, but also by strong public policies and market distortions. The effect of those one-sided factors is starkly illustrated by the case of Chicago where the street car (tram) was quickly displaced through the advance of the automobile (see Figure 1).

Figure 2: Urban sprawl is well illustrated by this suburb near Phoenix, Arizona. Homes are exclusively reached by road

Cities

The success story of the automobile may be seen as the main cause of urban SPRAWL and its consequences for people, their health and their quality of life (air quality, dilution of urban and neighbourhood fabric, distances travelled), and for nature (landscapes, open space, agriculture and bio-diversity). An extreme example is the endless suburban expansion in the USA (see Figure 2). The phenomenon of urban sprawl has been analysed by, among others, the European Environment Agency (EEA, 2006) (see Figure 3).

Figure 3: Urban sprawl was analysed, among others, by the European Environment Agency in its 2006 Report "Urban Sprawl in Europe"

In terms of mobility, the use of the car as the dominant mode ("auto-mobility") has entailed dramatic changes in both land use and individuals' behaviour.

In URBAN LAND USE, lower density and longer distances for urban trips have occurred, as an effect of motorisation. The car takes about 18 times more space than a pedestrian, as it moves, but it requires parking every time it does not move, i.e. most of its life cycle (see Figure 4). The 'land spread'

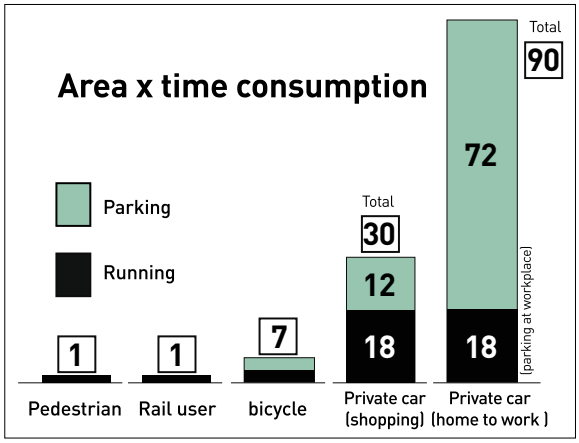

Figure 4: If one takes the land consumption by a pedestrian as the benchmark, the car takes up about 18 times more space than a pedestrian, as it moves, but it requires parking for the time it does not move, i.e. for some 90 % of its life cycle. Land consumption therefore has an area x time dimension
Source: Louis Marchand, RATP for UITP

effect is thus enhanced by this difference in scale of automobile use, up to one to ninety, as compared to the pedestrian/tramway city. This meant that short trips to proximity services that were once done by walking or cycling, became longer, even more so because the shortest way for the walker or cyclist is not generally the one used by the driver, as the road network is scaled for the automobile. As an example, a one way street system increases by half the average length of trips and the amount of fuel used.

Similarly, spaces used for recreation and amenity are in conflict with the ever increasing demand for parking space.

People

As to the urban dweller's HEALTH, the main effect has been the decline in walking as a means of transport, as muscle power gave way to fossil-fed horsepower.

This had effects not only on personal mobility (increase in vehicle km travelled) but also on environmental health (road accidents, pollution-related respiratory diseases and obesity). Among the related studies, the relationship between car use, obesity and carbon dioxide emissions has been the subject of a 2007 report by the Institute for European Environmental Policy and Adrian Davis (Davis, 2007).

The effects of urban environments on health (both physical and mental) were the subject of a 2008 Conference held by the UK-Man and Biosphere Urban Forum at UCL London. Proceedings were published under the title "Statins and Greenspaces" (Dawe, 2008). The contribution by William Bird and Huw Davies includes data from the UK National Centre for Chronic Disease Prevention which addresses the cost of additional healthcare due to inactivity, by age group (see Figure 5 and 6).

The data on ROAD ACCIDENTS collected by the former European Council of Ministers of Transport (now The International Transport Forum) reveal that 'road crashes account for 180,000 deaths every year in OECD and the ITF countries (....) while worldwide the WHO estimates the annual road deaths toll at 1.2 million people' (ITF, 2008)

Indicators of Sustainable Mobility – Findings and Comments

Indicators of mobility and land use were analyzed by the International Association of Public Transport (UITP) in its "Millennium Cities Database for Sustainable Mobility" (UITP, 2001). The data covered, among others, demography, urban economy, urban structure, number of

Figure 5: A dramatic rise in diseases linked to obesity is expected by 2023

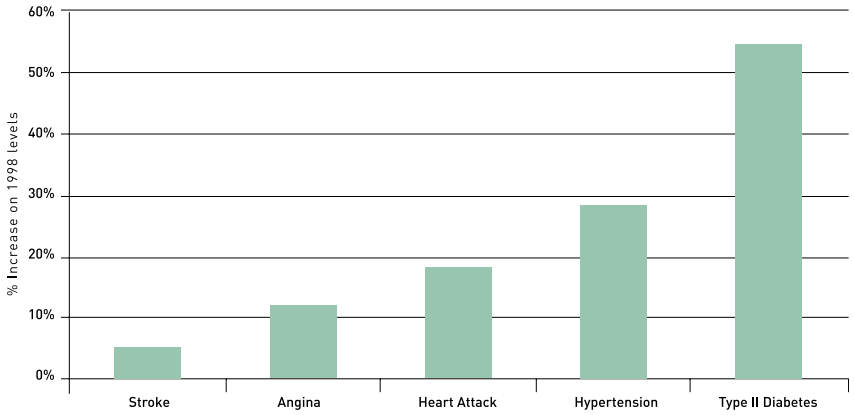

Figure 5: According to the UK Department of Health, the rampant increase in obesity will result in a strong increase in related diseases. Source: 2008 Conference held by the UK-Man and Biosphere Urban Forum at UCL London. Proceedings were published under the title "Statins and Greenspaces" (Gerald Dawe and Alison Millward, Eds)

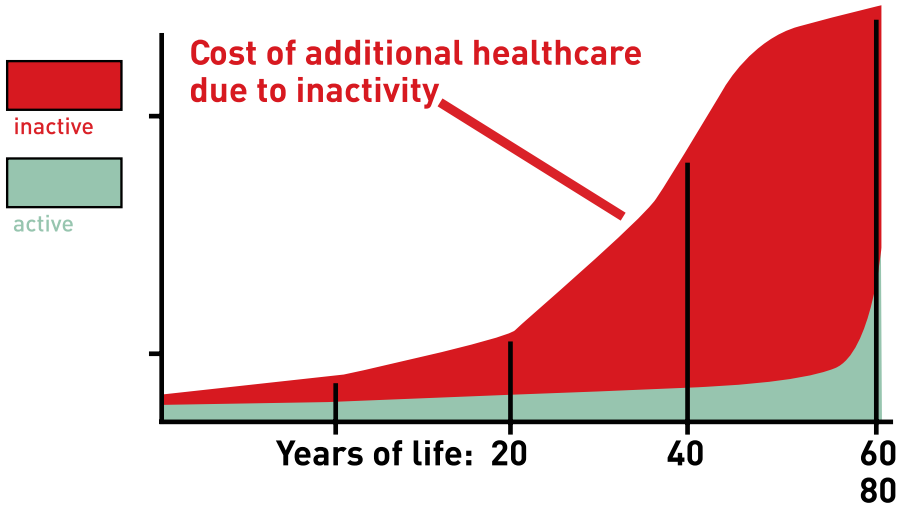

Figure 6: This graph shows the cost of additional health care entailed by inactivity as estimated by the UK National Centre for Chronic Disease Prevention Source: Dawe, G., 2007

Figure 7: Nantes has been a pioneer of the tramways revival since 1982, complemented today by a bicycle rental scheme. Tramways are not only a tool for sustainable mobility. They are an opportunity for enhancing the street network and creating pedestrian-friendly environments. As initiated in Karlsruhe, Germany in 1992, some tram networks are using existing railway tracks, and complementing them with new tramway routes, thus allowing seamless travel
Source: City of Nantes

Figure 8: Bordeaux opted for a light rail network instead of a metro line and connecting buses. A notable feature is the absence of catenaries (overhead and supporting poles) in the historic part of the city, for aesthetic reasons
Source: City of Bordeaux

private motor vehicles, taxis, road and public transport network, modal choice, transport costs as percentage of metropolitan GDP, energy consumption, pollution and number of accidents, but not health as such.

The general findings, analysed by J. Vivier, could be summarized and commented on as follows:

- Public transport consumes on average four times less energy per passenger-kilometre than the single-occupancy automobile. This includes both rail and road transport vehicles and is subject to strong variations according the density of land use and the level of operating subsidies.
- The dense cities of Europe, well served by public transport and non motorised transport modes, are spending much less for their mobility than the spread-out cities

Pierre Laconte

of America, both in monetary terms and in terms of accidents. Sustainable urban mobility requires an integrated supply of built space, public transport, parking and amenities. The higher the density, the higher the patronage. Notable exceptions exist in America, as illustrated by New York or Portland, Oregon.

- Growth in income does not necessarily imply an urban development model based on the automobile and urban sprawl. There is a clear relationship between public transport use and the supply of parking.
- Sustainable mobility calls for an integrated transport policy combining urban planning, parking controls and a significant role for public transport, so that this again becomes the mode of choice for all, as it once was, and not just of the elderly and the poor. In the tramway age, public transport was part of the mainstream urban economy, and not a social service. Public transport being part of the mainstream economy is not at all incompatible with subsidies to some groups of users. An early example was the cheap workers' commuter train pass system introduced in Belgium in 1869. This system allowed workers to continue living in their rural environment instead of agglomerating in suburban slums, as in France.

As an example of practical differences, the comparison between Bangkok and Copenhagen indicates the following:

- Bangkok is characterised by a high level of motorized mobility, entailing very long and costly travel times, and poor accessibility. Road investment, recommended by the World Bank, has been proven to be ill-suited to the dense urban structure of the conurbation, while public transport investment was deferred. In addition, the covering over of many canals by roads has markedly increased urban temperatures.
- In an outstanding contrast, Copenhagen spends only 4.1% of its GDP on transport, due to a combination of restrictions on individual automobile use and high use of the bicycle, notwithstanding the Nordic climate. Munich, Frankfurt, Vienna, Milan, Paris and London all spend less than 7% of their GDPs on transport.

Modal comments

In any intermodal comparative exercise a difficulty arises at the INTERFACE between transport modes. Complex daily trips (trips which are not only home to work) make up a growing proportion of the total. Calculations of cost and time are therefore increasingly difficult to make. A complex example is the place taken by trips to school in the total number of trips. Parents' safety concerns combine with status exposure to increase this type of trips.

RAIL mass transit is usually recognised as the best way to ensure citizen's mobility in large conurbations. The emergence of an efficient guided mode of transport serving a specific route usually entails a reallocation of trips to make use of this new mode where it is available. A case in point is the tram network of Nantes. The central city tram network has been planned for use as the only motorised mode for a trip, complemented by walking or cycling rather than by feeder buses or park

Figure 9: The Bogota TransMilenio is derived from the pioneering Curitiba Bus Rapid Transit (BRT) network that started in 1976 which has proven its mass transit capacity while providing for enhanced safety and security through its staffed stations. BRT achieves very high commercial speeds, as it is given a total right-of-way and all ticketing takes place at stations. Note the possibility of express buses to pass all-stops buses. In narrower roads and urban streets, space can be saved by using guided buses (e.g. through an optical guidance system) Source: Transmilenio

and ride (see Figure 7). Bordeaux has a comparable philosophy (see Figure 8).

'Park-and-Ride' may feed a rail system but the differential of land use requirement by pedestrians and cars cannot be forgotten. It means that "Park and Ride" consumes a huge amount of urban land that could be used more efficiently. "Kiss and Ride" and feeder buses can save the space used for day-long commuter parking.

The same is true for electric car/plug in vehicles. They certainly reduce direct pollution (indirect, greenhouse gas pollution depends on the source of the electricity supply) but they do not reduce the urban space consumed by the car, whatever its fuel.

Bus Rapid Transit (BRT) networks, with full right of way and off-vehicle ticketing are a valid and affordable alternative to mass rail transit. They are, however, more space-consuming, unless the bus is guided, for example

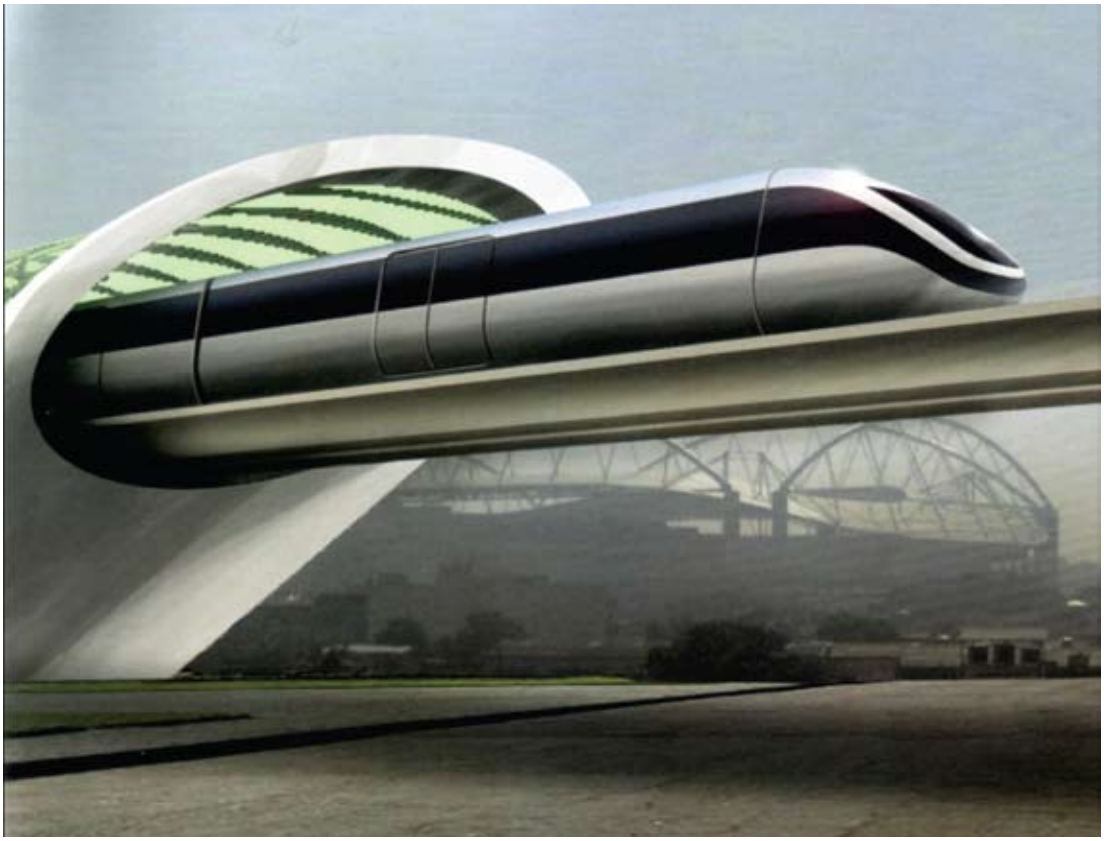

Figure 10: A glimpse into the future. For the occasion of the World Cup 2014, Porto Alegre (Brazil) intends to introduce the Coester AEROMOVEL, a pioneering, low-energy compressed air automated people mover (design e Arquitetura: Ado Azevedo). This system was first developed in Porto Alegre (inspired by a 19th century project by the British engineer Isambard Brunel), but, until now, only a short line operates in Jakarta, Indonesia. Other pioneering projects under implementation include the London Heathrow ASTRA Personal Rapid Transit system linking car parks to the Airport's Terminal 5

through an optical guidance system (Rouen). The pioneering BRT city was Curitiba, starting in 1976 and still expanding (Linha Verde). Its concept was successfully adopted by Bogota (see Figure 9). BRT has now been implemented all over world, in China (Kunming), India (Delhi), Australia (Brisbane) and Turkey (Istanbul).

Automated people movers (APM) have proven a mode well adapted to short distances (Trans.21, 2010), sometimes cable - propelled

An original very light APM is the Brazilian AEROMOVEL This compressed air propulsion system, was developed in Brazil by Oskar Coester and is due to open for regular traffic in 2014. The vehicle is driven by a pneumatic system which converts electrical power into compressed air and transmits thrust directly to the vehicle without gears or intervening electric circuits. Stationary electrical blowers, located close to the passenger stations produce the pressurized air needed to propel the vehicles (see Figure 10).

Figure 11: Copenhagen's high-density low-rise urban planning, its pedestrianised streets (introduced from 1962), its bicycle network (36% of commuters use bicycles, notwithstanding the Scandinavian climate), and its expanding driverless urban metro network have enhanced liveability. The Copenhagen metro lines also reinforce the "finger-plan", which concentrates development along public transport radial corridors
Source: City of Copenhagen

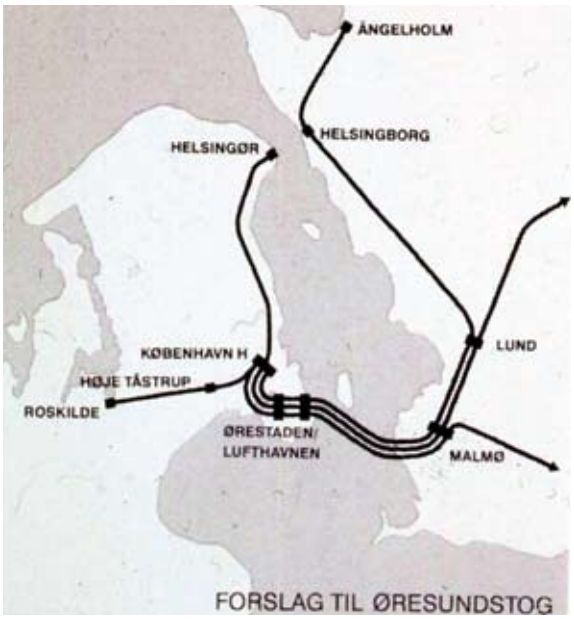

Figure 12: In addition to the intra urban metro, the commuter line linking Copenhagen, Kastrup airport and Malmo has created an integrated, trans-border urban agglomeration
Source: City of Copenhagen

Finally, one should mention public transport making use of individual vehicles, such as shared TAXIS, or taxis accepting several passengers, e.g. taxis equipped with a meter allowing fare reduction for each existing passenger if a new passenger steps in. They are well adapted to linear urban configurations, such as coastal cities (for example, Thessaloniki). Special mention must be made of car-sharing (or car clubs). While not an alternative to individual car use, it allows more efficient use of existing fleets (although less than shared taxis). Car sharing/car clubs recently started to attract car rental business (membership-based car-on-demand hourly rental schemes).

The availability of hand-held GPS path finding devices specially designed for pedestrians should also encourage walking without having to consult a city map. Signage giving distances or walking time to key destinations has proven to encourage walking (for example in Geneva).

Policies and Measures for a Sustainable Mobility – Some Practices

Achieving an integrated urban planning and mobility concept could include some of the following components:

Encouraging LIFE STYLES favouring non motorised transport clusters throughout the urban region, and reducing subsidies for fossil fuel.

Copenhagen is a notable example through its high-density, low-rise urban planning, its pedestrianised streets (introduced from 1962), its bicycle network (36% of commut-

Figure 13: Singapore Area Licensing Scheme 1975-2000
Through its pioneering restraint of car ownership (a monthly auction of new licensing plates, with a maximum yearly increase in car ownership of 2.5 %), its congestion pricing, its network of driverless subway trains linked with pedestrian malls and its highly convenient intermodal multi-use Easylink card, Singapore is considered a best practice in sustainable transport. Its "area licensing scheme" was launched in 1975, requiring drivers entering the city to pay a fee or accept three passengers. It confirms that oblique approaches are politically the most successful, especially in a difficult context (nobody could protest against such a scheme)
Source: author

Figure 14: In 2000 in Singapore the fee to enter the city was replaced by Electronic Road Pricing. The new system was applied to all drivers but the fee level varied according to the type of traffic congestion (the fee increases at peak times as a way to reduce congestion). This was also a signal to the user that the fee was in effect a congestion charge, not an additional tax on automobile use
Source: author

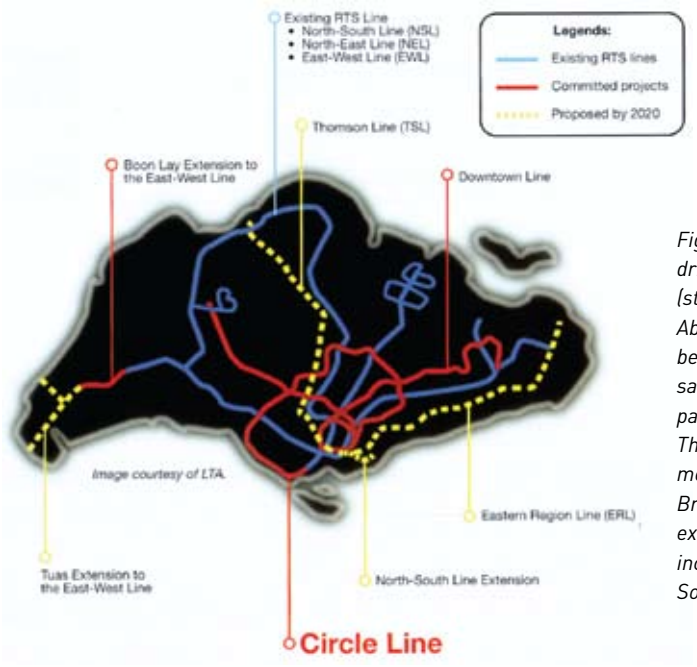

Figure 15: Singapore has been the pioneer of driverless high-capacity metro networks (starting with the North-East Line in 2003) Absence of drivers means shorter intervals between trains, higher capacity and higher safety levels. Most of the staff interfaces with passengers, rather than just sitting in a tunnel. This network has set the standard for future metros around the world. Nuremberg, Brussels and other cities are retrofitting existing lines to make them driverless and increase their capacity
Source: Land Transport Authority, Singapore

ers using bikes), and its expanding driverless metro network. The Copenhagen metro lines reinforce the "finger-plan" (see Figure 11), while the commuter rail line linking Copenhagen, Kastrup airport and Malmö has created an integrated trans-border urban agglomeration (see Figure 12). With changing urban life styles, more account is being taken of water in and around the city, not only as resource and tool for urban climate change adaptation but also as mobility tool. Copenhagen is a pioneer in this respect too, providing a year-round scheduled boat system, accessible with the same tickets as the metro and buses. A multidisciplinary approach to water in the city would lead towards water-centric communities (Novotny et al., 2010).

DECOUPLING income progression from increase in energy use by citizens of a city and its region.

The most obvious case of decoupling is affluent Singapore, through among others its pioneering car ownership restraint (monthly auction of new licence plates), its congestion pricing, its network of driverless subway trains linked with pedestrian malls, and its convenient intermodal and multi-use Easylink card (Mah, 2009). Singapore is considered a good example of integrated sustainable transport (see Figures 13-15). Protection of pedestrian walking in the streets in equatorial conditions could still be improved by trees providing shade and by canopies. In the case of multi-use cards, London's Oyster Card and Hong Kong's Octopus are also regarded as best practices.

Among smaller cities, Freiburg (Germany) is a notable example, thanks to its urban development clusters and its synergy between low energy buildings and low energy mobility. The university city of Heidelberg is also highly ranked. Even in lower density areas, such as rural cantons of Switzerland, public transport has a chance, if it is reliable (Mees, 2009).

The university town of Louvain-la-Neuve (New Louvain), 27 km south of central Brussels is

Figure 16: The university town of Louvain-la-Neuve (New Louvain) is a prime example of a sustainable, liveable development. It is centred on a new railway station and is entirely pedestrian, parking space being provided outside the town or underground. It has many ecological features and has a present population of 40.000. All storm water is led to a reservoir landscaped as an artificial lake, with a stable water level
Source: Wilhelm & Co.

an early example of transit oriented development (TOD) (Laconte 2009). Begun in 1969, it has become a regional growth magnet. This high density-low rise development, modelled after the historic university town of Leuven, is centred on a new railway station and is entirely pedestrian, parking space being provided outside or underground. The new town also displays many ecological features (see Figures 16-18).

Figure 17: View of the entrance to the railway station which is below this pedestrian street combining university buildings, shopping and residences
Source: author

Figure 18: View of one the numerous small piazzas on the pedestrian streets network. Cars are parked underneath
Source: author

Figure 19: Excellence in public transport – the City of Zurich, Switzerland
In Zurich, trams and buses enjoy absolute priority on street. When approaching a traffic light the sensor shown on the lower left ensures they have a green light at any time of the day. The City's modal split is around 80% in favour of public transport
Source: City of Zurich Police Department

Contributing to integrated mobility through effective tram/bus rights-of-ways and innovative use of rented bicycles for short trips.

Paris is a case in point. The extensive use of bus rights of way (more recently also for trams), protected by "banquettes" and passenger information about waiting times has triggered a strong revival of surface transport. The Paris bicycle rental "Velib" scheme, which provides close to 20.000 bikes dispersed around the city, is reported as having substantially modified life-styles in favor of non-motorized transport, as well as having been politically rewarding. Some 30 million rentals were recorded in the first full year of operation (2008), together with a 94% rate of user satisfaction. The scheme was pioneered in Lyons and is now replicated all over Europe, lately in

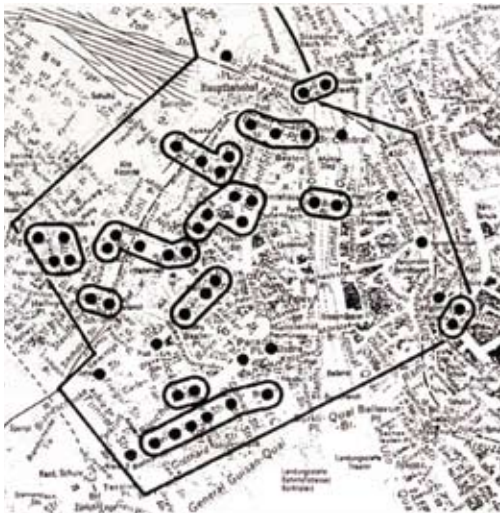

Figure 20: Zurich's automobile traffic calming through traffic light cycle control:Traffic-calming is ensured by adapting the traffic lights system (a much shorter cycle favouring pedestrians, cyclists and public transport)
Source: City of Zurich Police Department

London (see also Figure 7). The private investors and operators of the Paris scheme were among the 2008 Time magazine's "Heroes of the Environment". Extension of the system to the periphery and a network of bicycle lanes remain to be implemented (Guet, 2009).

London has also introduced a congestion charging scheme in its central area that has improved surface transport.

For very large world conurbations, the traditional underground rail system remains unequalled in terms of capacity and speed. While China - in particular Shanghai - has been the champion of fast construction of metropolitan railways (after years of absolute priority to road investments), followed by New Delhi, the state of the art system remains that in Singapore, with its high-capacity driverless trains (see Figure 15).

Figure 21: Zurich parking management

Unrestricted on-street parking is exclusively reserved for Zurich-registered residents, while automobile commuters entering the city from other municipalities are subject to limits on their parking time. Conversely, rail commuters have benefited from an increased service. The parking measure has brought a return of inhabitants to the city (who are able to park), and has been politically rewarding for the city fathers, while suburban rail travel has been made easierSource: City of Zurich Police Department

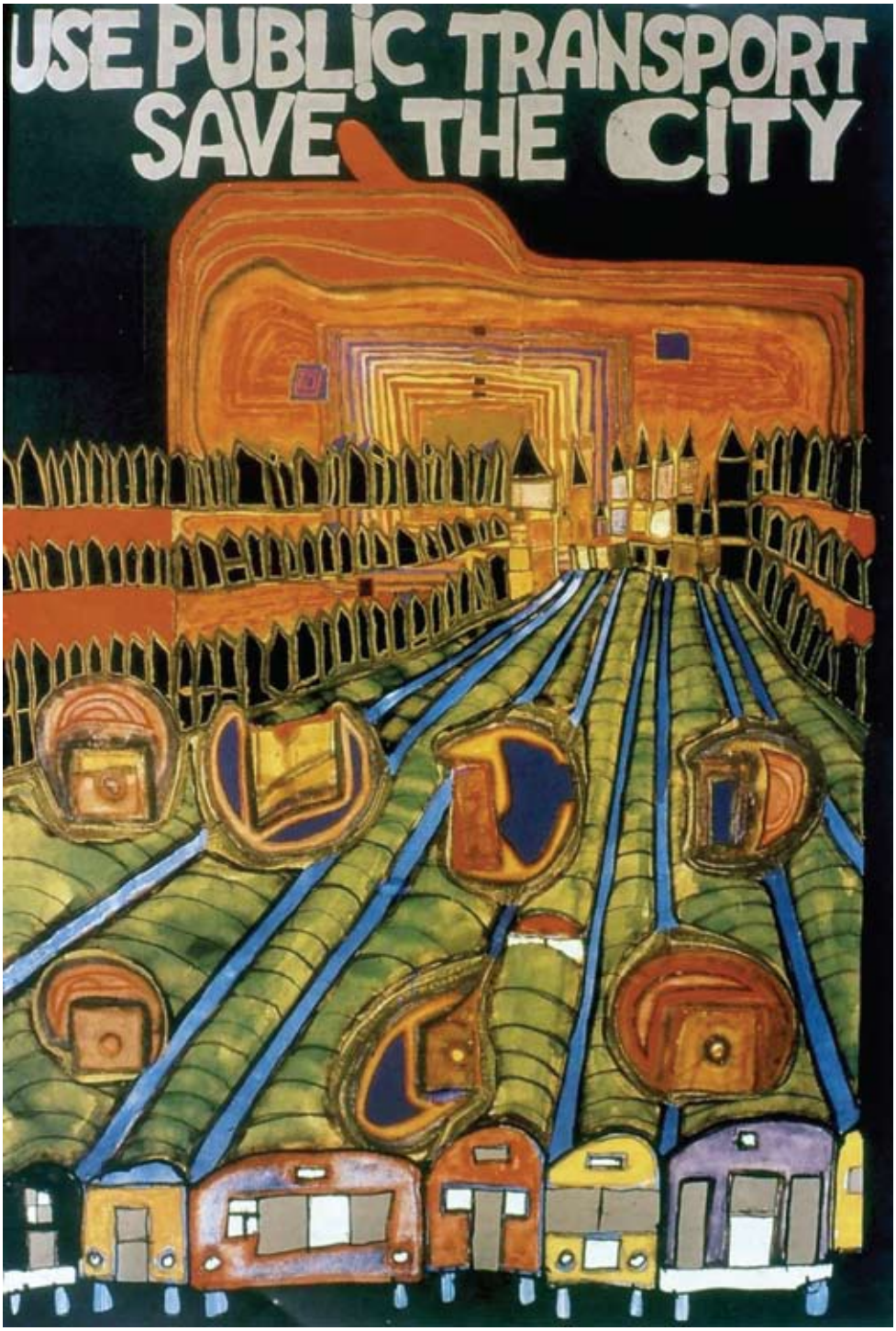

Figure 22: Mobility and Liveable Cities – the Transport Network Irrigating the City
Poster by Friedensreich Hundertwasser (1928-2000) for UITP (1991)

Assessing the health effects of the switch from motorized transport to non-motorized bicycle transport.

There may be a case for stronger collaboration between mobility and health services. As an example, the findings of Professor Richard Davison, of Napier University in Edinburgh (and Chair of the British Association of Sport and Exercise Sciences), quantify the benefits of cycling according to gradient levels. They confirm that hilly cities are not at all deterring cyclists: this is also shown by the Paris Velib' success, notwithstanding the hills. Effects of obesity and physical inactivity on health have been discussed above.

Implementing synergy between the supply of regional public transport and restraint on the use of the car in the city.

A case in point is the city of Zurich and its region. Trams and buses enjoy absolute on-street priority. Traffic calming is ensured by shortening the traffic lights cycle. On-street parking without a time limit is reserved for Zurich-registered residents with a sticker, while car commuters entering the city from other municipalities are subject to a limitation on their parking time. Conversely rail commuters have benefited from an increased service supply and easier rail travel. These parking measures have brought a return of inhabitants to the city (to be able to park) and have been politically rewarding to the city fathers, while suburban rail travel was easier for commuters. It also suggests that oblique approaches are the most successful, especially in a difficult political context (see Figures 19 -21).

Governance and continuity

Implementation of any policies and measures in favour of sustainable cities requires not only a tool kit but also appropriate governance and timing (Rydin, 2010). An outstanding example of governance and continuity is provided by the city of Bilbao, which was led by the same team since 1989 (Vegara, 2005). Bilbao was the winner of the Singapore World-Cities Award 2010.

Figure 23: Mobility and Liveable Cities - the Compact City Poster by Friedensreich Hundertwasser for UITP (1993)

Conclusion

The examples described in this paper suggest that the best contribution of mobility to sustainable cities is optimising the use of each transport mode and interconnecting transport modes, whatever the size of the city. That means namely:

- Encouraging non motorised modes of transport though pleasant walkways (including signs indicating distances by foot) and a bicycle paths system, with places to park the bicycles, and easy to use rental bicycles. Easy availability of taxis in the streets and of shared taxis (club taxis) are adding to sustainable mobility.
- Ensuring effective public transport: regional networks, networks of tram/bus benefitting from right-of-ways, and convenient intermodal hubs.
- Giving the car its proper place, preventing it from dominating the city and effectively limiting its speed.

Let us end by referring to the Austrian painter Friedensreich Hundertwasser (1928-2000) who summarized the contribution of mobility to the liveable city through three posters illustrating the notions of transport networks irrigating the city, the compact city as a prerequisite for sustainable mobility by favouring shorter trips, and citizen enjoyment as key to liveability (see Figures 22-23).

Acknowledgement

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