By Sir Peter Hall

NEW PERSPECTIVES ON TRANSPORTATION AND URBAN DENSITY

Urban planners around the world agree that the key to urban reform and creating sustainable cities is improved public transport infrastructure. However, an unresolved dilemma remains. Although experts seem to agree that we should aim to achieve more compact, higher-density cities, it seems that market forces are causing cities to develop in the opposite manner, spreading outwards and forming lower-density suburbs.

How do urban planners strike a balance and build suitable transit-networks that connect urban centres to ever-growing suburbs? Some experts argue that there is a solution. However, many believe there is not.

The case for public transport is twofold. Firstly, the underlying rationale is that diminishing fossil fuel resources and the imperative need to counter climate change will make it necessary to reduce dependence on fossil fuel travel. This is accepted by the majority of the world's scientific community.

Secondly, there is equal acceptance of the argument that urban sprawl will encourage more car travel. As homes disperse faster and more widely than jobs or consumer services, the said sprawl will increase journey lengths between homes and places of employment, and between homes and city-based services.

Encouraging People out of Their Cars

Australian urbanist Dr Paul Mees recently expressed a somewhat iconoclastic view on this matter. Dr Mees argues that the degree of automobile dependence in any city may be less of a reflection of urban form and density, and more an indication of the standard of public transport service.

To demonstrate this, Dr Mees showed that despite Toronto and Melbourne having similar urban structures with extensive low-density suburbs, Toronto achieved much higher transit use due to its high frequency of service that operated throughout the entire working day.

More recently, he extended his analysis to cover a wider range of differently structured cities, including Zurich, Vancouver, Ottawa, Curitiba and London. All of these cities achieve high levels of public transit use, whilst other similar places do not.

The key, Dr Mees argues, is to develop coherent networks. In a dispersed city, it is simply not possible to deliver a service that will do what the car typically does, which is to take the commuter, on command, from A to B. Yet, a transport system should offer seamless, convenient, easy and comfortable transfers at key interchanges. To achieve this, a city must develop a strong central infrastructure capable of achieving a high level of logistical coherance.

High-density versus Low-density Cities

Dr Mees argues that different cities, with varying geographies, have succeeded in developing a highly efficient transportation infrastructure, irrespective of their degree of urbanisation and dispersion. His research devotes an entire chapter to this issue, comparing densities and public transport use for cities around the world – a task that proved far from easy, because of the usual data problems.

Some odd results emerged from this research. Los Angeles, a metropolis with its notorious disregard for public transport, has the highest density of all of America's major urban areas, including that of New York City. However, the city's car dependence arises not from this, but because its city planners made a conscious decision in the 1920s to become a different type of city. At that time, it housed the most extensive light railway network in the world, but decided to favour automobile dependence.

Likewise, Zurich – one of Dr Mees' key case studies – is not an archetypal high-density European city, as it occupies mountainous terrain with many of its suburbs being dispersed hilltop villages. However, all areas enjoy the same, uniformly excellent, level of public transport service.

Dr Mees shows in detail how this uniformity is achieved, with buses connecting to suburban railways at guaranteed times and with extraordinarily slick connections. He does not mention that, by the standards of other transport systems, this means a very high level of investment in interchanges that remain almost unused for long periods each hour. This highlights the fact that Swiss rail managers view their service in the light of passenger convenience, not for the exploitation of their infrastructure. This is a critical difference in culture, compared to other cities and countries.

The outcome, from Dr Mees' analysis, is that a city's density is not critically important. Relatively low-density cities can develop effective transport systems, if they are organised properly.

Does Density Matter when it Comes to Good Infrastructure?

Zurich is viewed by almost all comparative infrastructure studies as one of the best served public transport cities in the world. Dr Mees shows that the overall urban density of Zurich is quite low, which is also true of parts of the city with effective transit service.

One reason for this becomes obvious from even a superficial look at a map. Located in the Swiss Alps, Zurich concentrates urban development into relatively narrow valley corridors, which provide almost the sole practicable routes for fixed-route transit services, leaving wide mountain areas that are both thinly populated and bereft of transport.

For a different reason, a similar distribution is observed in the Swedish capital of Stockholm, another celebrated European model of a transit metropolis. Here, much of the metropolitan area consists of lakes, concentrating all development and transport on to the relatively narrow intervening land areas.

In both these and in other European cities, the residual areas can be intensively used for land or water-based recreation. In Vienna, a vast upland area northwest of the city, the Vienna Woods, is permanently reserved for open-air recreation, with urban development surrounding it in narrow river valleys. Interestingly, the few North American urban areas that are shown as performing relatively well in transit service – including Vancouver in Canada and the US cities of Portland in Oregon and San Francisco in California – share these physical characteristics.

> "To achieve urban sustainability through transport planning, there is no substitute for a good public transport system that delivers a smooth, interconnected service throughout most – if not all – of the 24-hour day."

Dr Mees' argument fortifies another contentious research conclusion, from Marcial Echenique, director of the UK's Engineering and Physical Sciences Research Council-funded *Solutions* study, in that urban form has virtually no influence on sustainable transport patterns. However, other members of Echenique's team argue that density does indeed matter, in terms of adequate services at the neighbourhood level – a point with which Dr Mees might not disagree. Still, whatever the precise parameters, it is true that a highly dispersed, low-density pattern of living and working makes it increasingly difficult to maintain adequate transit service.

The successful transit cities Dr Mees discusses are generally medium-density with a degree of higher-density clustering – often due to physical features, such as mountains or water bodies, which sharply reduce the amount of land available for urban development. Dr Mees' argument, and the case studies he uses to support it, raises intriguing debates on seeking alternative ways to promote sustainable urban form.

There are several basic variables. These include the distributions of employment, residence and other traffic-generating urban functions; the densities necessary to support adequate levels of service (however these are defined) by different public transport modes (bus, light rail, heavy rail); and, more subtly, the precise ways in which transport networks connect urban land uses and activities.

The 'Beads-on-a-string' Model

It is no accident that diagrams of the transit metropolis that appear in in the classic texts of sustainable urban development are all similar. They typically demonstrate a 'beads-on-a-string' structure, with urban development clustered along transit lines that feature pyramids of local density rising to peaks around public transport stations or stops. These stations also serve as locations for concentrations of public and private services, and hubs for employment.

The original model that excelled was the Stockholm General Plan of 1952, in which new suburban development was clustered around the stations of the planned metro (Tunnelbana) system, with pyramids of residential density, which rose to a maximum at the major sub-centres of each cluster, typically every five to six stations along each metro line.

At these points, the plan provided for high-rise, high-density development (typically eight to 10 storeys) within walking distance of stations and services, with lower-density family-oriented housing served by feeder buses that terminated at interchanges next to the Tunnelbana station. At other stations, medium or low-density development predominated, all located within walking distance, and accessible by pedestrian and bicycle friendly routes segregated from motor traffic.

This model has since been successfully followed in many other cities worldwide, notably in Singapore. It has also been adapted to other urban transport options (light rail in German, Dutch and now French cities; Bus Rapid Transit (BRT) in the Netherlands and Latin America), to other urban forms (such as linear cities like the Ørestad new town in Copenhagen), and to different density parameters.

In the region, the typical East Asian variant, represented by Singapore and Hong Kong, lies at the high-density extreme. European examples, in the Netherlands and Scandinavia, typically illustrate medium-density variants.

Connecting the Countryside

Finally, there is a remarkable recent variant on the pattern, literally following the 'beads-on-a-string' model. This model includes development in extended village clusters along tram-train lines, which run on the street in central cities but then divert on to national rail lines, to run through open countryside between the cities.

The pioneer of this model, in 1992, was Karlsruhe in southern Germany, where one route runs for 200 kilometres, connecting a series of villages between Karlsruhe and another town in southern Germany, Heilbronn. It was followed in 2007 by Kassel, a medium sized industrial and university town in Germany, which has created a regional tram network running up to 40 kilometres into open countryside.

Other European cities have followed, most notably in the Netherlands where, since 2011, the new RandstadRail connects the cities of The Hague, Zoetermeer and Rotterdam by a combined tram-metro network, serving as the basis for extensive newly planned suburbs along the network and the tramlines that feed into the rail network.

Essentially, tram-train is a new technological and administrative innovation that is already demonstrating huge capacity to generate dynamic growth in expansive city regions around and between cities. This demonstrates the potential for new forms of urban growth.

The Challenges Facing Future Public Transport

To achieve urban sustainability through transport planning, there is no substitute for a good public transport system that delivers a smooth, interconnected service throughout most – if not all – of the 24-hour day. With this as its base, many different urban forms are then possible. However, it must minimise the need for car travel, and maximise the opportunities for short trips on foot and by bicycle, and on short-distance public transport, by planning different key land uses – residential, service, local employment – in close proximity.

This will mean higher densities close to stations and transport stops. Just how dense will be a matter of local circumstance and local choice. For longer journeys, the basic urban transport infrastructure – whether metro, light rail, or BRT – will cater for the greater bulk of travel needs, comfortably and conveniently.

This is a pattern already achieved in many of the world's cities that are cited, again and again, as examples of global best practice, from Singapore to Stockholm, Karlsruhe to Kassel, Bogotá to Brisbane, Copenhagen to Curitiba, Strasbourg to Zurich. The challenge now is for other places to improve and build on the lessons that these model cities have experienced.

1. **pg 32 - 33: Aerial view of Stockholm, with the metro (Tunnelbanna) in the foreground.**
   Photo credit: © 2012 Thinkstock
2. **pg 35: Aerial view of Zurich. Due to its mountainous topography, urban development is concentrated into relatively narrow valley corridors that are also almost the only feasible route for transit services.**
   Photo credit: © 2012 Thinkstock
3. **pg 36: The RandstadRail tram-metro system in Netherlands.**
   Photo credit: © 2012 Thinkstock
4. **pg 37: The BRT network spans throughout Bogotá, including in the historic downtown.**
   Photo by Karl Fjellstrom, itdp-china.org

Sir Peter Hall is Bartlett Professor of Planning and Regeneration at the Bartlett School of Architecture and Planning, University College London, and President of the UK's Town and Country Planning Association. He has a Ph.D. from the University of Cambridge and has taught at the London School of Economics, the University of Reading and the University of California at Berkeley. He has worked as a special adviser to numerous British and EU urban initiatives and is the author, co-author or editor of over 40 books on urban and regional planning and related topics. These include *The World Cities*, *Urban and Regional Planning*, *Cities of Tomorrow* and *The Polycentric Metropolis*.