

The costs and benefits of high-density urban living

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Hong Kong is renowned worldwide for its dramatic views of a forest of high-rise towers squeezed between its famous harbour and a backdrop of thickly-wooded hills. Constrained from expanding spatially by the shortage of buildable land, the Hong Kong Government's longstanding land policy has been to build up rather than out, thereby facilitating the housing of some seven million people, a world-class transport and logistics hub and a top-tier financial centre in just 1,068 square kilometres (412 square miles). All of this contributes to the exciting, bustling and cosmopolitan atmosphere that defines Hong Kong as one of the world's truly iconic cities. Yet, this excitement, and the efficiencies bred by proximity, carry a substantial price tag.

Hong Kong residents must cope with some of the highest population densities on the planet in an environment that is characterised by ranks of high-rise office and residential buildings, extremely limited urban open space, a measurable urban heat island effect and dangerously high concentrations of roadside pollution that fail to disperse from poorly ventilated street canyons. It is for good reason that the public policy think tank Civic Exchange characterised Hong Kong's urban livability (with apologies to Thomas Friedman) as 'Hot, Stacked and Crowded', in a report published in April 2010.

The impacts on public health are substantial. The best researched and best understood of these is air pollution, for which Hong Kong is sadly developing a growing international notoriety. Overseas concerns about Hong Kong's air quality range from warnings against travel by the Australian Government in 2009, to active promotion by Singapore of its clean and healthy living environment in its eternal battle to attract expatriate talent and investment away from

Hong Kong – a trend identified in report on the future of Asian Financial Centres by the City of London.

All of this begs the question: how bad is it really? Where Hong Kong scores well is that air pollution both from the city and the surrounding Pearl River Delta (PRD) region is actively monitored, and the public has access to that data. The Environmental Protection Department publishes an Air Pollution Index, which gives a number for the aggregated levels of four major pollutants – sulphur dioxide (SO₂), nitrogen oxides (NO_x), particulate matter and ozone. However, since high levels of NO_x generally coincide with lower levels of ozone, thereby effectively 'canceling each other out' and lowering the readings shown by the Index, the real threat to health from air pollution is systematically understated.

An alternative source of information is the Hedley Environmental Index (HEI) – a website developed by the University of Hong Kong's School of Public Health and launched in December 2008. It provides the public with real-time information on the measured concentrations of the four pollutants listed above, which creates a much more accurate picture.

The HEI goes a step further by providing the public with real-time information on the estimated impacts on public health by the current levels of air pollution. By calculating the estimated numbers of premature deaths, hospital bed days and doctor visits, using a scientifically robust, peer-reviewed methodology, it shows that air pollution has cost US\$261 million (HK\$2.03 billion), and contributed to 891 deaths, 67,890 hospital bed-days and some 6.6 million doctor visits in the last 12 months alone.

One of the key features of the HEI is to highlight the difference in emissions from different sources.

Hong Kong's ambient air quality (a combination of emissions from all Hong Kong sources, plus the pollution carried across the border into Hong Kong from the highly industrialised PRD region) is measured by general monitoring stations located some 20 metres (65 feet) above the ground. Roadside air quality is monitored at three stations situated much closer to ground level in three of Hong Kong's most developed and congested districts – the shopping meccas of Mong Kok and Causeway Bay and Central. The figures show that roadside pollution (of which NO_x is a major component) is consistently and substantially higher than the levels of ambient pollution.

Due to its high levels and ubiquity roadside air pollution poses a major component of the threat to public health. NO_x, which has been linked to reduced lung development in children and underweight births, is just one element. Particulate matter, especially diesel fumes, is responsible for a number of allergies and can also cause inflammation of major organs and blood vessels, leading to strokes, heart attacks and other acute conditions. More widespread complaints caused by Hong Kong's toxic cocktail include irritation of the eyes and nose, coughing, shortness of breath and an increase in, and more intense, asthma attacks.

These impacts are experiences disproportionately by the poor and by women. The poor tend to live in the most congested districts and fill the ranks of the professionally exposed, for example drivers, street-level stallholders and shop workers, while women are subject to all the same health threats as men, but must often shoulder a greater burden as the primary care giver, taking time off work to accompany an ailing grandparent to hospital or sit up through the night with a coughing child.

So, to rephrase the initial question: why is roadside pollution in Hong Kong still so bad, when it is known to be so harmful?

There are two major reasons. The first is that Hong Kong's vehicle fleet includes large numbers of diesel-powered buses and trucks, plus large fleets of LPG (liquefied petroleum gas)-powered taxis and minibuses. Many of these are ageing, and in the absence of effective regulations governing inspection and maintenance (Hong Kong's Air Pollution Control Ordinance only control smoky vehicles, not those generating invisible but equally harmful toxic pollutants such as NO_x), toxic emissions from these fleets are substantial and poorly controlled.

And herein lies a big part of the conundrum. Hong Kong is justly famed for the efficiency of its public transport, which is based partly on the high population densities that make public transport economically viable. However, the public transport franchises under which the buses and taxis operate are designed to ensure that the service provided is cheap, plentiful and roadworthy – but not necessarily environmentally friendly.

As public concerns about air pollution have risen so has pressure to rein in emissions from these sources. But newer, cleaner vehicles and retrofitting with catalytic converters will all cost money. Any investment must be recuperated through higher fares, and when such a large proportion of the population depends on public transport for its mobility, increases are politically difficult to secure.

The second reason is that the high population densities are brought about by the city's vertical approach to property development. While public transport benefits from the congregations of potential passengers, the same high-rise buildings ironically form the walls of the street canyons that make it so much more difficult for street-level concentrations of pollutants to disperse. This situation is exacerbated by the low provision of public open space and the consistently excessive height and width of buildings designed to take up every square foot of available land in order to maximise the economic returns.

Research by Hong Kong University of Science and Technology has shown that concentrations of roadside pollutants vary substantially between well- and poorly ventilated areas. The research also showed that differing levels of congestion and the overall number of vehicles also contributed to concentrations of pollutants, with the worst areas being those that combined high congestion and poor ventilation – total numbers of vehicles was a less significant factor.

As concern about air pollution has escalated so has public frustration about the lack of effective control measures. But air quality is now so poor that developers of new infrastructure projects are experiencing difficulties in meeting the standards required by Hong Kong's environmental impact assessment (EIA) process. Two major projects – the Hong Kong Zhuhai Macau Bridge, which is intended to connect Hong Kong with the western PRD, and the plans for adding a third runway to the airport, are providing an important opportunity for a new conversation about how to define the limits of sustainable development.

The EIA for the Bridge was challenged in a judicial review raised by a resident living close to the airport, over concerns about the impact of emissions from tens of thousands of additional vehicles on air quality and public health. The court found in favour of the applicant, throwing out the government's approval of the EIA on the grounds that air quality had not been properly assessed.

With aviation growing rapidly in the PRD the Airport Authority (AA) has begun to discuss the need for adding a third runway to the airport. A third runway would not only attract more aircraft, but also greatly increase the volume of traffic, bringing additional passengers, cargo and associated services to the airport. All of these will generate more emissions, particularly NO_x, and the preliminary report from the AA's environmental consultant notes that the new runway would only be able to operate at 40 per cent capacity if air quality standards are to be met.

Thus there is a growing understanding that Hong Kong's air quality is now directly threatening not only the health of its citizens but also the economic development of the city. The numbers involved are substantial. The AA has estimated that a third runway will cost US\$17 billion (HK\$132 billion) to build and generate economic benefits of up to US\$116 billion (HK\$900 billion). Businesses ranging from airlines to hoteliers, from engineers to banks, and even the Government itself, have a strong vested interest in seeing this project approved. The first signs are emerging that this will galvanise both polluters and regulators to act swiftly to find ways to reduce pollution to the point that an EIA for the third runway can be approved.

Reducing NO_x from road transport will be a major part of any successful control strategy. While the aim will be to reduce emissions in the immediate vicinity of the airport, cleaner vehicles servicing the airport area will also run clean elsewhere in the city, thereby helping to bring down the overall aggregate of pollutants from the fleet.

Reducing emissions is important because it is much easier to retire or properly maintain a fleet of buses than to knock down buildings in the densest areas for the sake of improved ventilation of overbuilt urban areas. But the very fact that such solutions are being discussed at all is an interesting indicator of the Hong Kong public's growing desire to follow the decades of prioritising economic development over the

environment with a rebalancing in favour of improving the public's health and quality of life.

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