

Monitoring Research Quarterly, MRQ is the newsletter of Auckland Council's Research and Evaluation Unit, RIMU.

Each edition of the newsletter contains reports of RIMU's current work including information about recent publications, research, facts and trends about Auckland. RIMU publications are available on the Auckland Council and Knowledge Auckland websites.

Improving air quality on board Auckland buses

Our bus services are improving and more Aucklanders are travelling by bus. This helps to reduce traffic congestion and pollution. Breathing clean air is critical to protecting our health. What is the quality of air in our buses? The cleaner the air is, the better it is for us to breathe. However, we don't know much about the air pollution concentration bus commuters are exposed to at different times of the day, at different locations or the underlying causes of the pollution concentration. To address some of these knowledge gaps, University of Auckland and Auckland Council scientists conducted a study on in-bus air quality.

Auckland Council continuously monitors a variety of air quality parameters and potential pollution sources at 12 sites across the region to gain a representative picture of ambient air quality (or outdoor air quality, for example, outside buses) and air quality trends. The study was undertaken specifically to understand air quality in buses.

Ultrafine particle (UFP) concentrations were measured continuously inside buses for Auckland's three Link loop routes: City, Inner and Outer Link. The City and Inner buses travel within the city centre mainly on bus lanes, while the Outer Link bus travels on arterial roads in residential areas.

The buses in the fleet were less than five years old and have Euro 5 diesel engines.

For the study, buses had air conditioning with windows closed during data collection.

UFPs are particles less than 0.1 micrometres (μ m) in diameter, mostly from vehicle emissions. Because of their extremely small size, UFPs are measured by the number of particles (pt/cm³). In comparison, commonly monitored PM₁₀ and PM_{2.5} (particles less than 10 μ m and 2.5 μ m in diameter, respectively) are measured by the weight of particles (μ g/m³). UFPs are thought to cause more severe health effects than larger particles, such as PM₁₀ and PM_{2.5} because they penetrate more deeply into the lungs.

UFP measurements were made on 68 trips during six weekdays in October 2013 and six weekdays in March 2014. Sampling took place simultaneously on the three routes during the morning rush hour when air pollution levels can be expected to be high.

The average trip concentration was found to be 17,300 \pm 14,600 pt/cm³, with the City Link mean concentration being 1.5 times that of the Outer Link. Auckland's UFP measure is relatively low compared to other cities (lower than Sydney, London and Boston; similar to Montreal and Helsinki), and ranked 12th out of 18 international studies. (Continued on page 2)



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It was also found that for trip concentrations, the within-route changes were greater than the between-route changes, despite differences in urban design, land use and traffic densities between routes. Therefore, the within-route UFP figures were further analysed to provide greater insight into the factors influencing the concentrations experienced by bus commuters.

A significant result of the analysis was the occurrence of rapid increases in UFP concentrations followed by slow decays ('spikes') during trips. A spike was defined as an increase of the UFP concentration by more than 10,000 pt/cm³ within a 10-minute period (approximately double baseline levels). Of the 68 trips, at least one spike was observed for 48 trips and a total of 82 spikes were recorded. Trips with one or more spikes had significantly higher trip average concentrations and variability (19,100 \pm 11,600 pt/cm³) than those without a spike (12,800 \pm 4400 pt/cm³). Therefore, reducing the occurrence of spikes during trips would significantly improve air quality on buses.

Spikes mainly occurred within the CBD and inner Auckland suburbs. The areas where there was a higher likelihood of spikes occurring had similar urban layouts with relatively narrow streets, flanked by tightly packed buildings with awnings, a high volume of traffic and close to traffic lights and bus stops. The ambient UFP concentrations in these areas were relatively high and able to infiltrate the bus cabin at the bus stops. On the other hand, only a few spikes were observed in the outer suburbs where there are fewer buildings and low densities.

In the literature, few studies have conducted an in-depth analysis of spikes while commuting by bus. Further analysis identified the main factors influencing the spikes in the Auckland buses. It was found that bus stops located closer to traffic lights were most likely to be associated with an increased occurrence of UFP spikes on buses, so were the slow moving buses.



This study has implications for improving air quality on buses. It appears that locating bus stops in areas away from traffic light intersections or areas of any significant amount of congestion could be an effective way for reducing the frequency of occurrence of spikes. Also, better ventilation on board buses could help reduce the lifespan of a spike if one occurs.

The research provides useful information about the daily patterns of air pollution and how the urban form is relevant to air pollution concentrations in buses. It also provides evidence for methods of improving in-bus air quality for bus commuters.

Map: Spatial distribution of UFP spikes with the location defined as the location of the bus at which a given spike began to occur.

Lim, S., Dirks, K., Salmond, J and Xie, S (2015). Determinants of spikes in ultrafine particle concentration whilst commuting by bus. *Atmospheric Environment*. 112, 1-8. For more information please contect Dr Xie, shanju.xie@aucklandcouncil.govt.nz

Recent research activities

RIMU's scientists, researchers, technical specialists and analysts have assisted with many Auckland Council projects over recent months. A list of recent publications and research related activities follows.

• New reports:

- Assessment of the CLUES model for the implementation of the National Policy Statement on Freshwater Management in the Auckland region, (TR2015/014)

- Ethnic precincts in Auckland: understanding the role and function of the Balmoral shops, (TR2015/015)

- Housing we'd choose: a study of housing preferences, choices and trade-offs in Auckland, (TR2015/016)

- Panmure Basin visitor survey 2015, (TR2015/017)

- Western Springs visitor survey 2015, (TR2015/013)

• Dr Trudie Cain attended the Academy of Super Diversity at the Max Planck Institute for the Study of Religious and Ethnic Diversity, Berlin where she presented RIMU's *Ethnic Precincts in Auckland* project.

• Dr Megan Carbines was appointed Honorary Academic Associate, Institute of Marine Studies, University of Auckland. • Scientist Marcus Cameron has received funding for a study of emerging contaminants in New Zealand. Emerging contaminants are any synthetic or naturally occurring chemical that is not commonly monitored in the environment but has the potential to enter the environment and damage ecologies or be dangerous to human health. Examples include pharmaceuticals, pesticides, flame retardants, plasticizers and hormones.

• An audit confirmed RIMU's ISO 9001:2008 Quality Assurance framework accreditation for environmental monitoring programmes.

• We hosted a RIMU Insights presentation by Sophia Beaton, Trudie Cain, Victoria Hearn and Helen Robinson, *Experiences of rough sleeping in central Auckland*

• Scientists and researchers wrote evidence and appeared as expert witnesses at the Auckland Unitary Plan Independent Hearings Panel hearings. Topics included heritage protection; volcanic viewshafts; rural subdivision, business and urban growth; and sites of significance to Mana Whenua.

The reports noted here are available on the Auckland Council or Knowledge Auckland websites.

New Zealand private rental market study

A major piece of research into the private residential rental market entitled *The New Zealand rental sector* is about to begin following the announcement of funding for the work through the Building Research Association of New Zealand, BRANZ Building Research Levy. The \$283,000 study, to be completed over the next 18 months, is a collaboration between Massey University, Otago University, and RIMU, and will combine statistical analysis, surveys and in-depth interviews in order to provide a more comprehensive understanding of this growing part of the housing market than is currently available.

The research has three distinct elements: First, Dr Lucy Telfar Barnard from Otago University will use administrative data held by MBIE, BRANZ, QV, and Statistics New Zealand to describe the physical characteristics, geography and demographics of the private rental market nationally, with detailed case studies of Auckland, Wellington, Christchurch, and Dunedin. This part of the study will:

- enable us to understand who rents what, from whom, and where;
- produce a modelled housing condition index to provide an estimate of housing condition in the absence of a national survey of housing condition;
- bring together these data sources to identify gaps and surpluses in the rental market in terms of housing availability and suitability;
- provide evidence about any differences in dwelling condition between owner-occupied and rented accommodation.

The second part of the project, led by Professor Karen Witten from Massey University, will survey 1200 tenants and 400 landlords resident in Auckland, Wellington, Christchurch and Dunedin using computer assisted telephone interviews (CATI). Demographic data will be collected from all survey participants, and the surveys will cover tenant and landlord views and experiences of the homes they rent and perceptions of the relationship they have with each other. Tenants will also be asked about their plans or priorities for change in their housing situation and the condition of their current dwelling. Landlords will be asked about priorities for change in policies relating to property investment and what changes would encourage increased participation in the private rental market. The survey will largely replicate a 2011 study conducted by Professor Witten and her colleagues, and this will allow for the analysis of change over time; for the new iteration, the project team has worked with the Auckland Council Housing Project Office, MBIE, and other housing researchers to ensure that the survey gathers data relevant to current workstreams and policy priorities.

The third part of the project, jointly steered by Professor Witten and RIMU's Emma Fergusson (Senior Researcher, land use and infrastructure), complements the quantitative data from the CATI surveys with in-depth qualitative interviews with at least 80 tenants, 24 landlords and 5 property managers. The qualitative interviews will enable a closer investigation of the dynamics of tenant and landlord relationships as they interact and negotiate on topics including bonds, property repairs and maintenance, and tenants' licence to make small changes to their living environment to better meet their household needs.

Narrative accounts of how past tenancies have ended are anticipated to inform understanding of experiences of the tenancy agreement. For tenants, such accounts are also likely to be informative regarding the meaning of 'home', their desires and experiences of tenure security or flexibility, and the impacts of insecure tenure and residential mobility upon different household members, including children and older people. For landlords, interviews will also include an exploration of their perspectives on the incentives and disincentives to provide rental housing (including new build) and the perceived benefits or otherwise of using professional property management services.

This research project is expected to be of interest to many people and organisations, including local and central government, and current and prospective landlords and tenants. In the context of a sustained and significant shift away from owner-occupation and towards renting (particularly in Auckland), and the review of the Residential Tenancies Act recently announced by the Minister of Building and Housing, a comprehensive and detailed analysis of the private rental sector is needed to inform public debate and policy-making.

For more information about the study, please contact Emma, emma.fergusson@aucklandcouncil.govt.nz

Auckland household labour force survey

Ross Wilson, analyst in RIMU's Economic and Social Research and Evaluation Team, prepares the Auckland regional household labour force survey quarterly overview using data supplied by Statistics New Zealand. Here are selected statistics from the most recent overview, March 2015.

At the end of the March quarter the overall Auckland unemployment rate was 6.9 per cent. The NEET (not employed in education or training) rate for youth aged 15-24 years was 11.1 per cent.

Over the year ending March 2015 on average in Auckland:

- The unemployment rate was 6.3 per cent, a fall compared to 6.8 per cent in the year ending March 2014.
- Female unemployment was still 7.7 per cent, while male unemployment had fallen to 5 per cent (from 7.8% and 5.9% respectively the previous year).
- The unemployment rate for people aged 15 to 19 was 24.2 per cent, similar to the previous year (25.1%).
- Unemployment rates among Māori (12%) and Pacific people (12.3%) were lower than the previous year (13.8% and 14.7%) but still remained higher than other ethnic groups.

The quarterly overview report is available on the Auckland Council and Knowledge Auckland websites. For more information please contact Ross Wilson, RIMU analyst ross.wilson @aucklandcouncil.govt.nz

Western Springs Park visitor survey 2015

An intercept survey of Western Springs Park visitors was conducted in January-February 2015, in order to improve Auckland Council's Local and Sports Parks unit's understanding of the experience of visitors in the park.

The survey results indicate that Western Springs is a popular park that attracts visitors from across the region.

The overall level of satisfaction with the park is high, with 95 per cent of visitors reporting that they are somewhat or very satisfied with the park. Most visitors (87%) rate the park as being important to their sense of well-being. Visitors use the park for a range of activities, including walking, spending time in nature, peace and quiet, feeding ducks and entertaining children.

Visitors provided mixed reactions to the possibility of making the park rubbish-free (removing rubbish bins and encouraging visitors to recycle their rubbish at home); with roughly equal numbers stating that this change would have a positive compared to a negative impact on their experience.

Although levels of satisfaction are high, visitors' responses indicate several possible areas for service improvement, including:

- · Increased cleaning of bird droppings from paths and seats
- Adding toilet facilities to the southern, Great North Road area of the park
- Improving the provision of seats and tables
- · Providing additional drinking fountains throughout the park

This, and forthcoming reports about Panmure Basin, Parrs Park and Orewa Reserve are available on the Auckland Council website. For more information please contact Dr Jesse Allpress, jesse.allpress@aucklandcouncil.govt.nz





For more information about Auckland related research, data and monitoring programmes visit the Research Unit's websites:

Knowledge Auckland

www.knowledgeauckland.org.nz

Monitor Auckland

http://monitorauckland.arc.govt.nz

State of Auckland

http://stateofauckland.aucklandcouncil. govt.nz

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