POLICY EVIDENCE SUMMARY June 2021

Delivering social and community infrastructure in Australia's growing cities

Based on AHURI Final Report No 356: New housing supply, population growth and access to social infrastructure

What this research is about

This research develops a quantitative geographic methodology to assess and inform the forward planning of social and community infrastructure in rapidly growing areas of Australian cities. It focusses on greenfield areas of Sydney, Brisbane and Perth greater metropolitan regions to demonstrate data sources and methods that are able to be replicated in other contexts.

The context of this research

Efficient access to social infrastructure is critical to sustainable residential development. However, planning, scheduling, and delivery of social infrastructure in greenfield growth areas remains a perennial policy challenge in Australia, with growth areas plagued by infrastructure lags and deficits which disadvantage new communities and undermine programs of new housing supply.

Coordinating the delivery of new social infrastructure and services is complicated by the fragmentation of delivery agencies; and the lack of coordinated and timely data sharing. New data sources and tools offer an opportunity to address this problem by providing more timely insights to inform the planning and provision of social infrastructure in rapidly growing areas.

"Efficient access to social infrastructure is critical to sustainable residential development."

The key findings

Overall, the project finds that widely available novel big data sources, when used in combination with traditional data sources such as the Census, can enrich spatial and infrastructure planning in high-growth areas of Australia. These data sources include:

- Geoscape buildings growth data—used to add urban development information to population data
- OpenStreetMap (OSM) – open-source map data
- median speed data for every road link across Australia used to measure travel time by car (2019 data by Compass IoT)
- General Transit Feed Specification (GTFS) data—used to measure travel times on transit in the cities of Sydney, Brisbane, and Perth.

The new datasets are available for very fine-scale geospatial analysis and are updated with greater frequency than traditional data sources such as the Census, and can be benchmarked against them.

Comparing spatial data to Census data

The research first establishes the ground conditions by analysing the population and dwellings growth profiles across Sydney, Brisbane and Perth, by comparing the 2011 and 2016 census data. It then performs fine spatial and temporal scale analysis of building growth in greenfield development areas in 2018-2019 across these three cities and, finally, presents a population estimation model in which building and development activity is used as a leading indicator for population projection.

The study uses these projected populations to compute spatial accessibility profiles to social infrastructure (schools and hospitals), comparing the performance of growth areas to regional urban accessibility levels, and identifying the hotspots of poor access.

Three greenfield development areas are identified in each of the three cities as case studies, and detailed analyses of buildings growth profiles are performed using the Geoscape data. Building point data is aggregated to the mesh-block level (a mesh block is the finest geographical area defined by the Australian Bureau of Statistics (ABS) at which Census information is collected), and quarterly longitudinal analysis of buildings growth is performed for residential and other mesh-block types for the year 2018–2019.

Using the data observations of increase in numbers and densities of buildings growth, an illustrative model of population estimation is proposed. It shows that the projections estimated using this model match well with the estimated residential population (ERP) data from the ABS.

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Dwelling densities

The research's maps of **dwelling densities by area** for all three cities show there is a steady gradient drop-off in dwelling densities with distance from the city centre. There are also hotspots of development in inner-city areas.

The **dwelling densities by population** maps clearly show that higher densities are correlated with the inner-city areas and the main transport and transit corridors, and, in general, low densities are correlated with the newly expanding outer fringes. This is a critical observation for the delivery of social infrastructure. The delivery of some types of social infrastructure might rely on a critical mass of population and dwelling densities, and inefficiencies or delays may arise if this critical mass is not reached.

The dwelling difference maps for Sydney, Brisbane and Perth over the period 2016–2011 show proportional change by SA2 areas (refer to the full report for maps). The inner-city hotspots of development are clearly visible; also visible very clearly is the growth in the respective priority growth areas in all the cities.

The research shows buildings or dwellings growth can be used as a leading indicator for population growth. There is a clear strong and positive correlation observed, for all three cities between population and dwellings growth.

Change in built-form density

Through the traditional data sources such as the 5-yearly census, or even state level approvals and completions data, quarterly or even yearly changes in actual built form are not detectable. But the change becomes clear when focussing on growth areas, at the level of individual buildings, through a data source like GeoScape.

This method relies on satellite imagery data being converted to vector data on building forms. For areas of low growth, an interval of one or two years will make little difference to the population growth estimates which are likely to be small. Thus, the key application is high growth areas with highly localised development, where population growth may occur suddenly in response to dwellings growth, and for which the timely and responsive planning of social infrastructure then becomes critical.

The research clarifies that as the built form changes, the relationship between population density and built-form density also shifts. This represents an important transformation, as the various density measures are strongly tied to accessibility to jobs and infrastructure. An area of potential improvement is to use the PSMA (Public Sector Mapping Agency) address database to identify building purpose and then estimate the number of dwellings in a residential structure.

Access to social infrastructure

Greenfield sites provide an opportunity to investigate planning for social infrastructure in a future-focussed strategic manner. This research proposes that accessibility—defined as 'the ease of accessing urban opportunities and activities'—is key to planning for the spatial distribution of social infrastructure. The concept of accessibility links:

- transport connectivity—transport infrastructure access points, travel networks, modes (including active modes), service frequencies and travel times on different modes
- opportunities available at any location.

Residents at a location need to access local infrastructure—for example, schools, hospitals, parks, libraries, community centres. They also need to access networked transport infrastructure that provides access to local and wider parts of the city.

Using schools and hospitals as demonstration areas, spatial accessibility profiles are created for a diverse set of travel-time thresholds.

A notable pattern emerging is that walking and transit access to social infrastructures in the growth areas invariably lags behind the regional average in all three cities. The gaps between growth areas and regional averages are most significant in relation to transit access. For example, the average individual in Ripley, Brisbane, is able to reach 0.6 public schools in 30-minutes transit, and in Yarrabilba 1.0 public schools can be reached. These figures compare to the regional average of 3.6 schools. In the growth areas of the three cities, walking access to schools and hospitals also notably lags behind. The gaps in transit and walking access suggest:

- lack of social infrastructure provision in the vicinity of growth areas
- insufficient transit services connecting residents with social infrastructure.

Automobile access to social infrastructure is universally higher than transit access across all three cities, but all access is lower in the growth areas compared to the regional average, bringing out that Australian cities are still car-based, and new areas significantly lag and underperform.

On average, each item of social infrastructure examined can be accessed by fewer people in greenfield areas than those in the whole region. A major explanatory factor for lower accessibility to infrastructure affecting all three greenfield areas is urban form and density. For social infrastructure provision to be economically feasible, a critical population threshold that is being served must be reached.

The accessibility pattern in greenfield areas inevitably pushes the choice of transport mode in those areas towards higher car dependence. People in greenfield areas without access to cars lack a safe and financially sustainable means of transport. Apart from environmental concerns, the additional volume of car travel between city centres and greenfield areas adds to the congestion problem that major cities are already experiencing.

Panel discussion

In order to gain industry insights, and to identify areas of interest and lags, the research included a panel discussion with participants from local and state governments and private industry. Workshop participants all asserted the importance of using data that is more 'real-time' than the Census when tracking or predicting population growth. This reflects the constantly changing demographics of the cities, which are due to:

- internal and external migration
- changing community aspirations and behaviours
- response to extreme events—such as the COVID-19 pandemic.

Panellists agreed that the tool could support ongoing evaluation of plans and their implementation. For example, if a plan proposes certain population or density targets, then an ongoing accessibility analysis could show whether or not the targets are being met.

Difficulties with data sharing

There are difficulties in data and information sharing across agencies, and in translating data insights into funding and delivery priorities. There are also difficulties around accessing valuable data maintained by individual government agencies, despite increasing commitment to open data platforms. Further efforts to develop innovative measures for understanding and informing social infrastructure requirements and provision in Australia should address these implementation challenges.

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What this research means for policy makers

The findings of the study have four implications for policy development and practice.

1. There is an opportunity to improve planning and coordination of new development areas in metropolitan and regional Australia through the use of new analytical tools and methods, such as those demonstrated in this project. In particular, novel 'big data' sources should be incorporated to inform evidence-based planning, after ensuring that they are accurate and reliable.
2. Open data platforms, including data on existing and planned social and physical infrastructure, should be shared across government agencies, researchers, and members of the public. This would ensure that common datasets are used to inform planning and decision-making processes. This has begun to occur—but progress to-date is slow.
3. Fine spatio-temporal scale building and construction data should be used as a leading indicator for small area population projection models, in the short term. 'Spatial accessibility profiles provide a powerful basis for community engagement around priority development and infrastructure decisions. They can be extended to many thematic applications—from schools and health facilities, as demonstrated in this project, to parks, recreation, or retail services. As well as informing planning and funding decisions, the accessibility profiles provide a powerful measure of urban performance and spatial equity.
4. The accessibility profiles can be used to inform and measure progress towards sustainable transportation and a reduction in car dependency. Accessibility profiles can be measured for different modes, such as walking, cycling, car-driving and transit, as well as for chosen infrastructure dimensions. Planning process can prioritise accessibility through transit and active modes of transport.

Further efforts to extend the use of big data in planning and infrastructure provision will help improve Australia's housing and urban development outcomes in the future.

Methodology

This research explored large spatial data sources and development of novel quantitative analytic methods in three cities for case studies: Sydney, Brisbane and Perth, and conducted a workshop with local and state government officers and private industry consultants and practitioners to reveal how the tool could be beneficial in different policy and planning contexts.

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