Residential growth planning and the tyranny of distance

Centres-based residential intensification is a common policy in New Zealand's main urban areas. Theoretical catchments oriented around convenient walking distance and the iconic 800m radius circle have come to dominate this thinking.

It is proposed that these circles are not entirely suitable for this task given the significant oversimplifications they rely on about what is walkable, and what is developable.

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The proposition that intensification around centres will bring benefits and efficiencies to low-density settlements has been corroborated repeatedly in international research. These locations offer the best opportunities for people to engage in social, economic, environmental, and cultural exchange with the least amount of energy input. Newman and Kenworthy, 1999[1], have succinctly summarised the issue (p 58):

"The economic analysis...suggests that something fundamental has gone wrong with our approach to cities when we plan them around automobiles. It is quite simply the biggest part of the sustainability agenda for cities to reverse these patterns and achieve an approach that reduces the environmental and social impacts of excessive automobile usage while simultaneously improving the city's economy."

Such settlements appear to typify the New Zealand dream to date: the Auckland Regional Council, 2009[2] (p 14) has stated that current development patterns are part of a "...private car culture". The Ministry of the Environment, 2005[3], has outlined some of the problems these patterns have been associated with (p 9): *"...traffic congestion, unsustainable energy use, overloaded urban infrastructure, a lack of distinctive identity, social isolation, and reduced physical activity with its associated problems such as obesity, diabetes and heart disease."*

It is not proposed to revisit these arguments here; suffice to say that policies calling for consolidated urban forms anchored around centres (and passenger transport spines) have been adopted widely across New Zealand. As one example, the Reasons for Objective 6.1 of the Christchurch City Plan, 2005[4], state: *"Studies undertaken by the council point to urban consolidation being the most sustainable urban growth option... consolidation is more energy efficient and has the least adverse effects...."*

Radius circle

The 800m circle has become accepted as representing a convenient 10 minute walk for most people in a community (based on a walk speed averaging 1.3m/s across the journey and including minor delays). This is of course a normative, average journey. People walking slower at 1m/s average will cover around 600m; those walking faster at 1.5m/s average may cover around 900m.

Climate and in particular topography also play a part – walking speed will reduce by 15 per cent or more once gradient exceeds 10 per cent (Ladetto, et. al., 2000[5]). Perceived safety, route quality and interest, and land use attractors are also critical. Ewing, 1999[6], has summarised a number of other factors which can encourage pedestrian activity.

If walkability is to be a key determinant of where intensification should be favoured, then catchments should be based on some reasonable, realistic measure appropriate to the whole community and applied through a wide filter of local geospatial characteristics. Auckland City, in its *Growth Management Strategy* 2003[7], identified a number of 'Areas of Change' to concentrate new growth (Figure 1). These are defined by an 800m radius circle. Radius circles of 1000m have been applied to the Newmarket and Otahuhu Areas of Change, identifying that these centres offer particular amenities and services whereby people are assumed to be willing to walk farther to access them.

For the purposes of this article, the 10 minute / 800m distance will be adopted as an appropriate, robust measure for a community walking catchment.

Deconstructing the circle

The 800m radius circle encompasses approximately 200ha of land. But it is worth contemplating the nature of circles. A doubling of radius will generally quadruple the area within it; a 400m radius circle

1 P Newman, and J Kenworthy, 1999, 'Sustainability and Cities: Overcoming Automobile Dependence', Washington: Island Press.

2 Auckland Regional Council, 2009, 'Long Term Council Community Plan 2009 – 2019', Auckland: ARC.

3 Ministry for the Environment, 2005, 'New Zealand Urban Design Protocol', Wellington: MfE.

4 Christchurch City Council, 'Christchurch City Plan', Christchurch: CCC, Partially Operative from 21 November 2005, http://www.cityplan.ccc.govt.nz/NXT/gateway.dll?f=templates&fn=default.htm.

5 Q Ladetto, et. al., 'Human Walking Analysis Assisted by DGPS', research paper, Geodetic Laboratory, Swiss Federal Institute of Technology, Lausanne, Switzerland.

6 R Ewing, 1999, 'Pedestrian and Transit Friendly Design: A Primer for Smart Growth', Washington: Smart Growth Network.

7 Auckland City Council, 2003, 'Growth Management Strategy', Auckland: ACC.

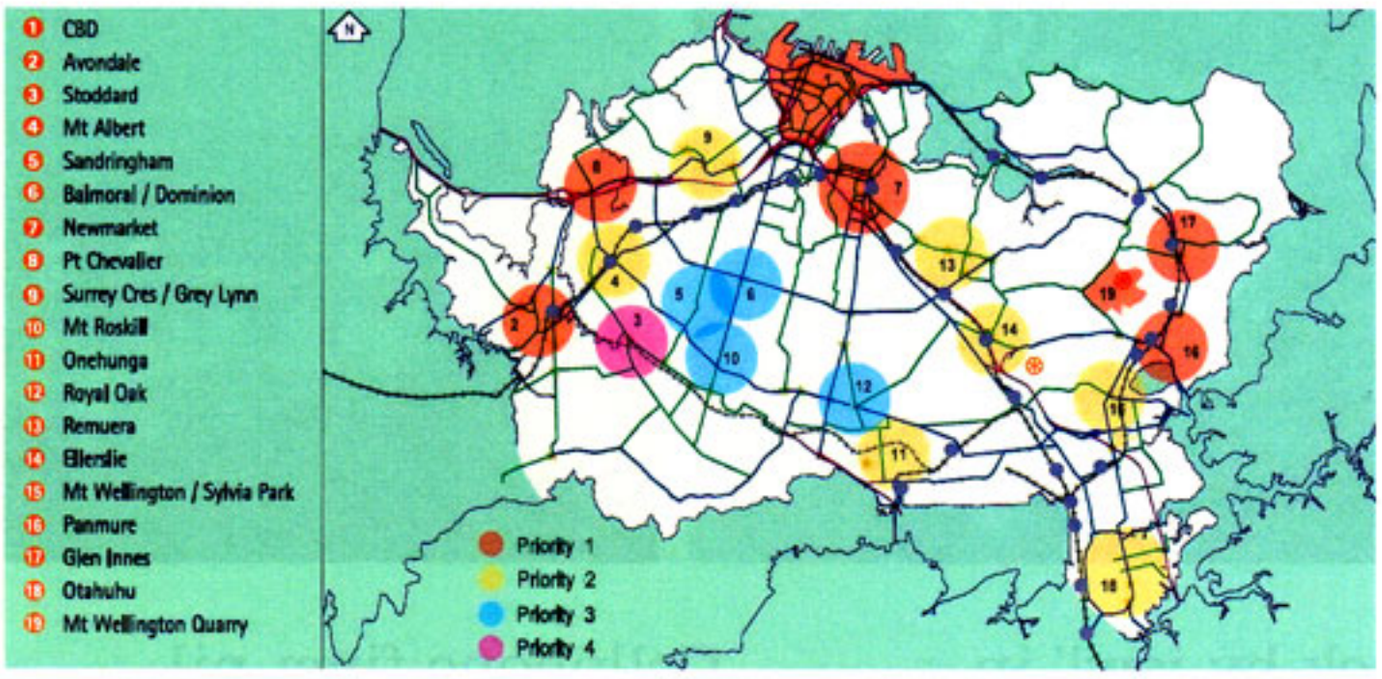

FIGURE 1: Areas of Change, from Auckland City Growth Management Strategy, 2003

encompasses 50ha, and a 200m radius circle 12.5ha. The implication for growth planning is clear – the greatest amount of area (and hence land possible for intensification) will always exist at the periphery.

The emphasis must be in ensuring that people can walk as much of the 800m as possible. Severances including highways, rivers, and indeed large urban blocks will limit the 'as the crow flies' distance inside that 800m radius circle which can actually be traversed by the pedestrian. Second to outright physical severance is major route delay, usually manifested at very busy road crossings. A major arterial road geared towards vehicle movement efficiency with a one minute signal delay for pedestrians will reduce walkability by 78m (or more), or around 10 per cent of the trip length.

Roads, open spaces, schools and the like, will not tend to be developed for residential activities. This necessary infrastructure can require 30 per cent to 40 per cent of gross land area – the finest-grain grid structures can see up to 36 per cent of available land used *just for roads* (CMHC, 2002[8]). Critical employment or business areas which are not highly compatible with residential development should also be subtracted from the residential development pool, including in some instances generically zoned 'mixed use' land. Large undeveloped blocks should have some provision for these inefficiencies made.

Once the land area has been corrected around actual walkability an understanding of the amount of land that is developable for residential activities will become clearer. Experience suggests that in many centres this may be as little as 30-40ha. This will still be a misleading figure. Orientation, historical boundary alignments, building stock issues, and topography will in particular work to limit the efficiency at which land can be developed. It may also be unrealistic to assume that the available land will all be developable within a 20 or even 30 year timeframe. Once these have been factored in, less than 50 per cent of the land identified as theoretically developable may be realistically available. This can feasibly drop well below 10 per cent of the initial 200ha circle.

Additional limitations

Despite generous site coverage, height limits, and floor area ratio controls, residential units require circulation space; visual separation; daylight access; and some outlook area. There is often additional demand for surface area such as for private open space or car parking / manoeuvring. Much of a theoretically developable site will not be occupied by residential buildings.

The North Shore City Council, in its *Good Solutions Guide to Mixed Use Development in Centres*, 2005[9] (p 29), recommends that around 14m is the maximum ideal depth of a residential building before more complex solutions for daylight access are required (such as central light shafts whereby habitable room windows must face internal common hallways). Depths of up to 8m can deliver acceptable levels of daylight if coupled with appropriate stud and window heights. Combined with a circulation core this can deliver building depths of 20m or more.

To achieve visual outlook as an appealing amenity rather than just an absolute minimum privacy space, it is suggested a separation of at least 20m between buildings be encouraged. When this is factored with maximum residential building dimensions, a residential building site coverage of between 30 per cent to 50 per cent may be at best all that is possible. Residential towers commonly represent 10 per cent or less site coverage. An estimate of 40 per cent is proposed as a generous rule of thumb for intensive residential building coverage. While some solutions can exceed this coverage, they tend to be on smaller blocks that are well served by roads and voids (i.e. the land inefficiency has been addressed previously in the urban structure). Multiplied by an estimate of likely habitable levels this will then identify a gross floor area (GFA) which approaches what may be a realistic estimate.

There should then be one final discount, being the internal circulation and other common spaces within buildings which should not be considered as net habitable residential floor area. This can range from anywhere between 10 per cent to 20 per cent of the total area. This final residential GFA can then be divided by an average unit size to give an estimate of likely unit numbers possible.

Summary: Only a fraction of land will be built on.

These come together to reduce the amount of residential floor area plausible within a growth centre. It is this heavily reduced figure that should form the basis of growth capacity modeling and planning. In summary:

- 800m radius circle needs to be reduced to an 800m walkable catchment;
- walkable catchment needs to be reduced to a gross developable area;
- gross developable area needs to be reduced to a net developable area;
- net developable area needs to be reduced to a gross building area;
- gross building area needs to be reduced to a net residential floor area; and then
- this can be used to give a more realistic estimate of units deliverable in the catchment. **U**

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8 Refer to Canada Mortgage and Housing Corporation, 2002, http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/socio75.html.

9 North Shore City Council, 2005, 'Good Solutions Guide for Mixed Use Development in Town Centres', Takapuna: NSCC.