An Analysis of Walkability in a Late 20th Century Masterplanned Suburb on Australia’s Gold Coast.

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Introduction

This paper presents some of the findings of a case study carried out on the suburb of Robina Woods in the Gold Coast City, Queensland, Australia (Fig 1).

The study examined the barriers to pedestrian connectivity that were built into the design of the town to meet a market urbanist and car focused development ethic. Car focused design produces an urban form that causes unnecessary pollution, CO2 emissions, and fuel consumption. It also contributes to lower economic, environmental, health and social outcomes for residents associated with sprawl development (Corti et al., 2008; Ewing & Kreutzer, 2006; Frumkin H, Frank L, & Jackson R, 2004).
Robina Woods

Robina Woods was selected as a study area for walkability due to its central position in the Robina/Varsity Lakes development. Certain residences were selected for investigation for their proximity to the major identified barriers and their geographical position in the suburb. The destinations chosen include all the major destinations within the suburb and the local amenities within a theoretical fifteen minutes walk of the suburb edges (see Fig 2). There are two pedestrian exits on the western boundary of Robina Parkway but these are of limited value as pedestrian routes. The Robina Woods Golf Course defines the southern and eastern boundary but there are no public pathways through the golf course. Vehicles can only exit the suburb through its northern boundary to Cheltenham Drive.

Figure 2: The study area (shaded) selected residences, local destinations, and major connectivity barriers

Robina Woods is a physically large suburb with over 1200 dwellings, and 3200 residents. It measures about 1.1 km North to South and 1.2 km East to West. The homes are either in cul de sacs or on the local collecting roads. In the 2006 census Robina had a density of 12.94 people per hectare (Gold Coast City Council, 2007). In Robina Woods there has been a trend to build larger homes since building started in the early 1980s, with smaller homes and plots in the north of the suburb.
Mapping pedestrian connectivity

The Planning Institute of Australia, in conjunction with the Heart Foundation and the Australian Local Government Association, has produced a draft document which intends to provide a national perspective on the nexus between health and the built environment (Australian Local Government Association et al., 2008). The influence of elements in the built environment diagram reproduced in this report and the examination of factors conducted in the field visits and mapping investigation led to a proposed model of the factors that can determine urban connectivity (Fig 3).

Figure 3: Identified Barriers to Pedestrian Connectivity in Robina (source author)

The barriers to pedestrian connectivity that are the focus of this paper can be described as spatial and physical in the context of universal design for all residents. The spatial barriers are distance and time, proximity of origins to destinations, and spatial layout of the development. The physical barriers include car focused road design and private open spaces. These barriers negatively affect the residents who do not use or have access to cars.

Distance and time are very important measures of connectivity (Carmona, Heath, Oc, & Tiesdell, 2003; Walton et al., 2007). The spatial layout of paths and roads directly affects the ability of pedestrians to reach destinations in acceptable time limits. For planners these times and distances have been based on a five or ten minute trip and a 400m and 800m distance from point of origin. Urban design practice has tended to map these distances using circles overlaid on a map. This practice does not account for the spatial layout of developments or the existence of barriers to pedestrian movement. In the mapping enquiry residences were
selected for their geographical position and their proximity to destinations within and local to the suburb. The ‘pedshed’ maps produced show the distances that were achievable in a five and ten minute walk. Even so the pedshed maps presented can only be considered to be indicative of how far it is possible to walk in the time available, as climate, terrain, slope and road-crossing time will affect the actual distances achievable.

The walking speed adopted for this paper is 4.5 km/h per hour, giving a walking distance of 375 metres in 5 minutes and 750 metres in 10 minutes. This has been converted from studies indicating older pedestrians walk at 4.11 ft per second (US Roads, 2008). The shorter distance is seen as more appropriate than the usually quoted 400 and 800 meters as pedestrians are usually either younger or older than average (US Roads, 2008). The quote by Bernard Isaacs, “Design for the young and you exclude the old; design for the old and you include the young,” (Corti et al., 2008) supports a slower walking speed.

The walkability indicated on the pedshed maps west of Robina Parkway is considered unlikely. Many residents would either not know about, be able to navigate or use the routes especially at night as there is no lighting on the paths (Fig 4).

![Figure 4: A pathway in Robina Woods](image)

The walkability north of Cheltenham Drive is subject to the pedestrian ability to cross the road. Waiting time and the necessary diversion from the desire line to access the three pedestrian crossings along Cheltenham and Cottesloe Drives restricts the
permeability for pedestrians. The roundabout and median strips offer limited accessibility for anyone who is slow to cross a road as the highway has four lanes and the traffic is fast and frequent at most times of the day.

There is some consensus in contemporary sustainable design literature about urban connectivity. The Urban Design Alliance of Queensland (UDAL, 2005) writes about places being physically connected with a multitude of fine mesh through-routes. The Urban Design Compendium recommends the grid as the spatial model for mobility networks for pedestrians and vehicles alike (Walton et al., 2007).

Mapping pedsheds

The pedshed maps presented show the best and least connected residences. Residence 6 (Fig 5) located in a gated community, was selected as the residence in Robina Woods physically closest to Robina Town Centre, destination A.

![Pedshed map for residence 6](image)

This residence is the least connected address in the suburb. It is only 660m in a straight line to Robina Town Centre, but residents have to drive 4080m to get there. The community has 94 residential addresses and no destinations within a ten-minute walk.

Residence 2 (Fig 6) was selected, as it is closest to The Quays shopping centre. Residence 2 benefits from its position adjacent to the intersection to achieve the best
penetration of the local street structure of any of the residences chosen. It has two destinations within 5 minutes and one further destination within 10 minutes.

Residence 10 (Fig 7) was selected as closest to Varsity College. A conventionally-drawn pedshed would imply that residents of this house could access six destinations in ten minutes. The mapping analysis indicates a pedestrian cannot reach any destination within 5 minutes. This map is significant for school children, as much of Robina Woods is in the catchment area for Varsity College.
The research indicates the northern boundary residences near pedestrian crossings have the best access to amenities. However, the crossings are over 350m apart. The majority of residents in the suburb are affected by their proximity to barriers and the limited directional choice of the road hierarchy as it emanates from their homes. Within Robina Woods, western residences are most affected by Robina Parkway and the cul de sac road structure. Geographically central homes are most affected by the Parkway and the golf course. Those homes within the “Gallery” estate are most affected by the golf course.

Pedestrian pathways in Robina Woods are not a common mobility option for residents. Paths are fragmentary, often between homes at the end of a cul de sac with two metre fences both sides, and unlit at night (Figs 4 & 8). This makes the roads the more likely and similarly suboptimal route for pedestrian travel.
Route Deviation Index

The second set of maps are an analysis of the distance by road and in a straight line from each of the selected destinations to each of the selected residences in the Robina Woods study area. A calculation was made of the variation between travel distance in a straight line and the actual traveling distance by calculating the actual travel distance as a percentage expression of the straight-line distance. This percentage can be used as an index of the distortion caused by the design of the road network. This distortion we have called the Route Deviation Index (RDI).

An area of Vancouver, Canada (Fig 9), five kilometres south of the CBD, was chosen for comparison to Robina Woods. The suburb was chosen because - like Robina Woods - it accommodates large open spaces and major destinations, and - unlike Robina – it has a grid street layout. Vancouver as a city was chosen as it often makes the top ten in the world ratings for green and sustainable cities (Shepherd, 2007). The RDI calculations for Vancouver’s grid system consistently gave a range of 135 to 140. This would appear to be a useful benchmark for a connected level of RDI as many writers recommend the grid for connective network systems (Berman et al., 2007; Carmona et al., 2003).

Figure 9: Aerial view of the suburb of Vancouver chosen for a comparative study. (Sourced from Google Earth 2009)
The following diagrams (Figs 10 & 11) simplify, compare and illustrate the nature of the road connectivity in Robina Woods and Vancouver. The red lines are the main roads and the orange lines indicate local residential roads. The arrows indicate if travel is possible beyond the end of the drawn line.

Figure 10: Vancouver street connectivity diagram

Figure 11: Robina Woods road connectivity diagram
The distance and possible routes from the each of the selected destinations to all ten selected residences of the study area, Robina Woods, were mapped and measured. These were used to construct a mean average and range of RDI for each destination and the residences. The maps selected here demonstrate the extent of route distortion caused by the impermeable boundaries.

Travel distances from Destination A (Robina Town Centre) to residences in Robina Woods (Fig 12) range from 2620m to 4080m.

![Figure 12: Journey routes from destination A to selected residences](image)

The longest distance is to residence 6, physically the closest home in the study to Robina Town Centre. The mean RDI for the selected ten residences to Robina Town Centre is 239 with a range of results from 117 for residence 2, to 618 for residence 6.

The mean RDI for the selected ten residences to Parkway Medical Centre (Fig 13) is 204.5 with a range of results from 117 for residence 2 to 1045 for residence 1. The cul de sacs and restricted access to the arterial road produce most of the route deviation for this destination.
The mean RDI for the selected ten residences to Robina State School (Fig 14) is 172 with a range of results from 142 for residence 7 to 229 for residence 9. The golf course is the main determining factor for route deviation to this destination.
The mean RDI for the selected ten residences to Robina Village Shops (Fig 15) is 129 with a range of results from 117 for residence 8 to 229 for residence 9. The alignment of the dendritic road system means that this destination is well connected to the suburb. The Golf Course is responsible for route deviation in the south of the suburb.

Figure 15: Journey routes from destination F to selected residences

The mean RDI for the selected ten residences to Varsity College (the local state school) (Fig 16) is 220 with a range of results from 147 for residence 2 to 438 for residence 10. Cul de sacs and the golf course produce most of the route deviation for this destination.

Figure 16: Journey routes from destination H to selected residences
The costs of car dependent urban design

Calculations were made of the cost of excess extra travel that the disruption to the connectivity imposes over and above a benchmark RDI of 140. These figures were based on published 2008 RACQ vehicle ownership costs averaged in c/km (Green, 2008). Another calculation was made of the extra CO2 emissions produced by the excess travel based on 2.3 kg CO2 produced per litre of fuel (timeforchange.org, 2008). These figures indicate there are financial and environmental costs to the Robina Woods residents for the excess travel distances imposed on them by the suburb’s golf course and road design.

An example was calculated for a family of four in residence 6 with two children at Varsity College and a parent working at Robina Town Centre. If 5 return trips to Robina Town Centre and Varsity College are made each week, an extra 47.96 km is travelled over and above the distance travelled over a grid road system. This means if they drive a Honda Civic Hybrid 1.3 CVT, it will cost the family an extra $31.46 per week, and 5.07 kgs of excess CO2 emissions will be emitted. If they drive a Ford FG Falcon XT those figures will be $38.27 and 7.19 kgs.

The car dependant urban design model employed in Robina Woods isolates the young, and elderly, disabled and those with no access to a car. Walkability is severely restricted by the design and spatial layout of the street patterns. The urban connectivity to the neighbouring suburbs is poor by all modes of travel especially to Varsity Lakes and Robina Town Centre, the two most important local destinations.

Conclusions

In conclusion, it can be seen that residents of Robina Woods have little ability to travel by anything other than private vehicle to the amenities, facilities, and employment they need within or outside of their suburb. There is currently no viable option to meet these needs within the community due to the lack of destinations within Robina Woods.

The research emphasises a need for a change in the way that urban designers and planners measure the pedestrian access to homes, amenities, and other destinations and encourages the adoption of a lower walking distance of 375m for a five-minute walk.
The presence of layered barriers to pedestrian mobility is an area that warrants further research effort, and the identified barriers to pedestrian mobility is a suggested starting point for that research. The significant barriers identified in the research were arterial roads, the separate land uses, and their spatial arrangement, and private open spaces that are inappropriate to the urban fabric.

The Route Deviation Index (RDI) is proposed as a measurement tool to analyse connective routes for pedestrians, cyclists, public transport, and vehicles. The index can also be used to estimate the probable excess costs of extra travel distances, to determine an optimal position for the siting of facilities and amenities and to consider improvements to existing routes and determine optimal mobility networks.

If nature can devise such perfect networks for the distribution of resources and energy as the leaf illustrated on the cover page of this paper, why can’t planners, designers, architects, engineers, and developers do the same?¹

References:


¹ Notwithstanding Christopher Alexander’s message that “a city is not a tree”.

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