

# The effects of pedestrian delay and overcrowding on our streets & the rationale for shorter blocks and through blocks links

Karl Brierley Autumn 2013

# Table of Contents

Introduction .....	3
Types of pedestrians .....	4
Browsers.....	4
Commuters.....	4
Pedestrian Activities.....	5
Necessary activities .....	5
Optional activities.....	5
Social activities .....	5
What is the issue with overcrowding?.....	6
Walking speeds and distance .....	7
Pedestrian delay.....	8
Platoons.....	9
Fundamental issues with overcrowding.....	10
Negative effective on commerce .....	10
Detrimental effect on optional and social activities.....	10
Those with Special needs/Children not provided for.....	10
Bad for encouraging people to walk.....	10
Benefits of improving the pedestrian realm.....	11
Through block links.....	13
Optimal block size .....	14
Current Council policy on Shorter blocks .....	16
Key findings and highlights.....	17
References.....	18

# Introduction

Footpaths are a city's "most vital organs"<sup>1</sup>, they must not be exclusively seen as thoroughfares for pedestrians traversing the city. Footpaths function as social places where people gather to talk or meet friends, to stroll, and window shop, or to sojourn and watch others go by. Footpaths are assets that are both a route and a destination.

Ideally, a sidewalk should be wide enough to accommodate pedestrian movement as well as seating, trees, public transport shelters, and other appropriate amenities that support social activities.

Sidewalks are generally divided into three imaginary lanes<sup>2</sup> ;

Next to the shop windows is a lane that is about 0.6m to 0.9m wide which is used as viewing space used by window shoppers,

*"What attracts people most, it would appear, is other people." William Whyte*

At the curb, people generally allow 0.4m - 0.5m between themselves and any street furniture, thus creating a second lane.

In between these two lanes is the space that is left to the walkers. There is a minimum desirable width for this walking space, 2.4m, or the amount of space necessary for two pairs of pedestrians to pass each other comfortably.

There is no rule of thumb for the maximum width of a walking space; but having too much space is just as undesirable as having too little. **Error! Bookmark not defined.** Too much space can make a footpath seem 'empty' as people are distributed over too large an area which detracts from the liveliness and vibrancy of a space<sup>2</sup>.

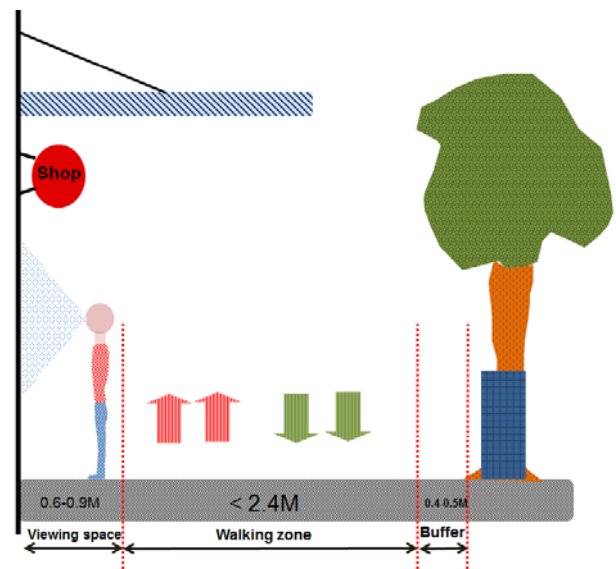


Figure 1.

## **Types of pedestrians**

There are two distinct types of pedestrians that are defined by their primary functions <sup>3 4</sup>;

### **Browsers**

This type of pedestrian consists of tourists, casual shoppers, window shoppers, workers during lunch breaks or others with time on their hands. These pedestrians do not follow a predictable pattern and often interact and linger at areas of interest. These walkers place a value on safety and personal security. They will also place a high value on amenity of the public realm and on the quality and mix of attractions available.

### **Commuters**

These are pedestrians who require clear, direct routes between specific destinations such as employees going between work and home, shoppers with clear goals and business visitors. Such walkers therefore place a value on being able to walk more quickly and without interference from the congestion of others. These pedestrians function efficiently and quickly.

## **Pedestrian Activities**

There are three types of outdoor activities that take place in public spaces, they can be categorised as follows<sup>5</sup>;

### **Necessary activities<sup>5</sup>**

These are activities that are more or less compulsory. Activities that fall into this category include going to school, waiting for Public transport, running errands and going to work. Because the activities in this group are necessary their incidence is influenced only slightly by the physical framework. These activities will take place regardless of the quality of the physical environment as the participants have no choice.

### **Optional activities<sup>5</sup>**

These are activities that people are tempted to do when climatic and environmental surroundings are inviting and attractive. Activities in this category are such things as taking a walk to get fresh air, standing around enjoying life or sitting and relaxing. These activities are highly sensitive to quality and generally only occur when the quality of the surrounding physical environment is high.

### **Social activities<sup>5</sup>**

These activities occur when people move about in and around the same space. Social activities include watching, listening, interacting with other people, active participation and finally as the most widespread social activity- passive contacts, that is, simply seeing and hearing other people. They develop in connection with the other two activities because people are in the same space, meet, pass by one another, or are merely within view. This implies that social activities are indirectly supported whenever necessary and optional activities are given better conditions in public spaces.

It is imperative to provide a rich environment that fosters the ability to cater to all of the above activities. On streets of poor quality only the bare minimum of activities takes place, as people tend to hurry home, however in a good environment a completely different broad spectrum of human activities is possible<sup>5</sup> above.

# What is the issue with overcrowding?

A certain level of crowding makes a street lively, inviting and vibrant. However there is a level at which overcrowding goes beyond the point of acceptability and creates an uncomfortable and unacceptable environment for all users of the footpath.

The problem is quantifying exactly what constitutes 'too crowded'.<sup>6</sup>

Pedestrian overcrowding can simply be defined as the point beyond which movement is restricted and personal space invaded. Footpaths should always possess the ability to accommodate a pedestrian flow comfortably, even in the most congested situations. An overcrowded street is a clear sign of a poor walking environment.<sup>7</sup> When overcrowding occurs, 'walking turns into a fight' to get from one point to another.

Footpaths can become overcrowded with such heavy numbers of users that they no longer allow for normal function to occur, effectively curtailing the use of the footpath to all users. In engineering terms, pedestrian overcrowding is identified when a footpath, is operating over capacity. Capacity refers to the maximum possible ability to accommodate a pedestrian flow.<sup>8</sup>

When a street approaches capacity it begins to prioritise those that are walking over those who are using the street for other purposes. Walking for transportation becomes the footpaths' primary purpose and the pedestrian the primary user,<sup>9</sup> which causes tension and conflict between competing footpath users.

Gehl<sup>10</sup> concludes that 13 people per meter per minute of footway is the maximum at which a comfortable level of quality can be delivered for a footpath, anything over this number is deemed overcrowded and has a detrimental effect on the quality of the footpath.

The LOS, see figure 2, for pedestrians is defined as "an overall measure of walking conditions on a route, path or facility"<sup>11</sup>. There are six different levels of service (LOS), A through F, that are used to detail the quality of pedestrian flows based on available effective walk or manoeuvre space per person. Levels of service are therefore based not only on volumes, but also on sidewalk or crosswalk area.

*"The presence of great numbers of people gathered together in cities should not only be frankly accepted as a physical fact. It follows that they should also be enjoyed as an asset and their presence celebrated". Janette Sadik-Kahn*

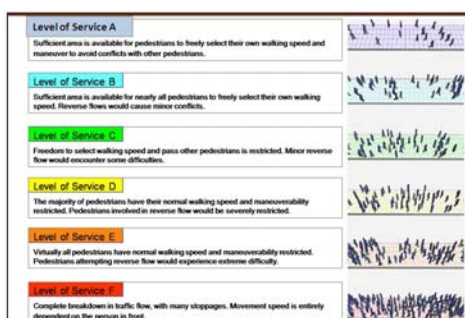


Figure 2

The level of service provided to pedestrians should be based on the freedom to select normal locomotion speed, the ability to bypass slow moving pedestrians, the relative ease of crossing a flow and the ability to change the direction of travel at various pedestrian traffic concentrations.<sup>12</sup>

Gehl's number of people per meter deals with the level of quality for all users of the footpath. The level of service methodology assesses the ability of the footpath to provide for pedestrian flows. Although both methodologies assess the same space from different perspectives they both arrive at the conclusion that crowding is a highly undesirable occurrence on footpaths as it has a negative effect on all users of the space.

## Walking speeds and distance

The ability for pedestrians to select their own walking pace and speed is a qualitative measure of convenience. Walking time and walking speed are the main factors that influence the distance that pedestrians can comfortably travel.

The average walking speed for a fit adult across a range of studies is found to vary between 0.76 and 1.76 m/s<sup>12 13</sup>. Australian standards for signal timing purposes use a pedestrian crossing speed of 1.2 m/s this caters for 85 percent of the population<sup>14 15</sup>.

The reasonable distance that a pedestrian is assumed to be able to cover is taken as 400m or a 5 min walk. There is evidence, however, that much longer walking distances are accepted in larger cities. The limits of human walking distance are related more to the physical environment than to energy use<sup>12</sup>.

Pedestrian speeds and pace vary according to the time of day and the trip purpose. The morning rush hour is the fastest time of the day in terms of pedestrian speed. People walk progressively slower as the day wears on, however the evening rush hour is also fast, but more sociable**Error! Bookmark not defined..**

Crowding has an adverse effect on the ability of a pedestrian to choose their own locomotion speed "As volume and density increase, pedestrian speed declines. As density increases and pedestrian space decreases, the degree of mobility afforded to the individual pedestrian declines, as does the average speed of the pedestrian stream"<sup>16</sup>. When a pedestrian is forced to walk at half their normal pace their movement is reduced to an uncomfortable shuffling gait<sup>12</sup>.

Characteristics of a congested flow are shuffling and dodging, the need to change trajectory and speed in order to avoid conflict and stop and start conditions<sup>17</sup>. This type of environment is unacceptable both for pedestrian locomotion and other users of the footpath as no enjoyment can be derived from navigating in and around a tumult of other pedestrians in order to avoid conflict and physical contact.

# Pedestrian delay

Pedestrian delay can be simply as defined the amount of time that a pedestrian has to wait between the point in time at which they become stationary at a kerb on one side of the street and the point in time in which they leave the kerb to resume their journey to the other side of the street.

The RTA<sup>4</sup> estimates that time wasted by pedestrians delays on business trips is valued at \$ 39.04 per hour, compared to \$ 12.20 per hour for private users in 2011 dollars. According to Jan Gehl<sup>18</sup> thirty per cent of walking time in Sydney is taken up by delay.

Pedestrian signals if poorly operated can create unnecessary delay. Pedestrian delay and non-compliance go hand in hand, this is of significant importance when pedestrians are waiting to cross at a signalised intersections<sup>19 20 21</sup>.

Pedestrian non-compliance behaviour is encouraged by signal timings that are not favourable to them. Non-compliance to traffic signals can pose a substantial risk to the pedestrian and other road users, and as a result, pedestrian delay quite quickly translates into a road safety issue. A study of pedestrian crashes at crossing facilities in New South Wales and Victoria<sup>22</sup> found that illegal pedestrian movements featured in 32-44% of pedestrian crashes at signalised intersections.

Research universally indicates that pedestrians' impatience and risk taking behaviour significantly increases after 30 seconds of delay; therefore, 30 seconds has been suggested as the maximum acceptable average pedestrian delay<sup>23 24</sup>. Pedestrians are more likely to become impatient when a red man continues to be shown during periods of low vehicle flow<sup>25</sup>.

Reducing delay to people walking is a basic design objective of traffic engineering and transport planning throughout the world. Vicroads aims to to provide a high quality road system that is for all road users. VicRoads is committed to reducing pedestrian delay by providing a high standard level of service under the *Smartroads* program. Figure 1.2 is

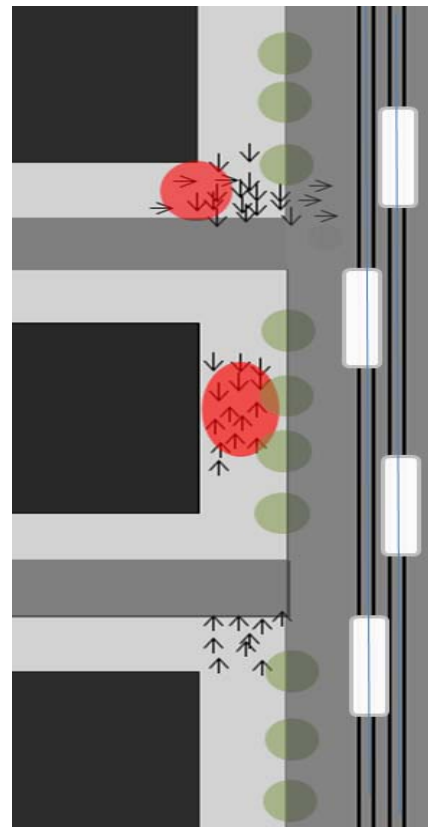



Figure 3 Red spots indicate areas of conflict

Transport type	LOS	Description
Pedestrian 	A	Crossing opportunities are within 25m of demand. Minimal delay in crossing.
	B	Crossing opportunities are within 50m of demand. Average delay before being able to safely cross is less than 30 sec.
	C	Crossing opportunities are within 100m of demand. Average delay before being able to safely cross is less than 45 sec.
	D	Crossing opportunities are within 200m of demand. Average delay before being able to safely cross is less than 60 sec. Significant numbers of pedestrians start crossing illegally.
	E	Crossing opportunities are within 400m of demand. Average delay before being able to safely cross is less than 90 sec.
	F	Crossing opportunities are more than 400m from demand. Average delay before being able to safely cross is more than 90 sec.

Source VicRoads

taken from the smart roads manual.

Pedestrians will almost always take the most direct route to their destination, therefore delay is linked closely with pedestrians propensity to take risks. Knowledge of pedestrian rules does not seem to be the issue; rather, pedestrians want to cross where it is convenient for them, and with as little delay as possible<sup>19 26 27 28 29</sup>. The reduction of unnecessary



delay for pedestrians would result in encouraging pedestrians to use crossings correctly and reduce risk taking<sup>25</sup>.

## Platoons

Excessive delays at busy intersections causes increased groupings of pedestrians; this grouping causes a sense of crowding. As the number of pedestrians gathered grows they begin to form a platoon, the longer they are forced to wait the larger the platoon grows. The location of the platoon at the corner impedes the path of those pedestrians who are crossing from the other corner **Error! Bookmark not defined.**<sup>8</sup>. See figure 3.

When the platoon of pedestrians is permitted to cross the intersection they move off together in their platoon for a block or more. Approximately half way along the next block they encounter another platoon of pedestrians which triggers a highly undesirable series of stop starts, changes of trajectory and speed by both sets of pedestrians. This conflict between bi direction flowing platoons forces those who are enjoying and using the space to seek refuge, involuntarily join the platoons or weave in and out to avoid conflict with the platoons **Error! Bookmark not defined.**

# Fundamental issues with overcrowding

## Negative effective on commerce<sup>7</sup>

When a footpath is operating over capacity it has a direct impact on the comfort level of 'browsers'. Since people are restricted in the manoeuvrability options available to them they cannot easily cross a pedestrian flow, stop where they want or look at window displays without causing an obstruction to the pedestrian flow.

*"There's a direct relation between how people get around and how much money they spend" "A pedestrian can just stop and walk into a store, which means more feet in the door and across the threshold" Janette Sadik-Kahn*

## Detrimental effect on optional and social activities<sup>7</sup>

Optional, social and incidental activities are severely restricted due to the overcrowded environment. Options for watching, listening and interacting with other people are limited. No space is left for those who wish to sojourn due to the transient nature of those using the footpath primarily as a route.

## Those with Special needs/Children not provided for<sup>7</sup>

Those in wheelchairs, parents with strollers, people with disabilities, children and the elderly generally need more space for walking than available on a crowded footpath. These groups can be deterred from walking under such crowded conditions.

*Council has received correspondence from a member of the disabled community who finds it increasingly difficult to use Swanson Street due to the excessive crowds of people moving through the area.*

## Bad for encouraging people to walk<sup>7</sup>

People will not be willing to use these areas, other than for necessary activities, if they are not provided with a good quality walking environment.

## Adverse effect on road safety<sup>7</sup>

Fast moving pedestrians will move out onto the road to pass slower moving pedestrians. Slower moving pedestrians and those who are using the footpath for social purposes can be forced into the road due to competing pedestrian flows.



Figure 4 Collins Street heading towards Southern cross

## Benefits of improving the pedestrian realm

Improvements in the public realm can have significant positive effects on the local economy. Conventional transportation planning practices suggest that personal motor vehicle travel is far more important than walking<sup>30</sup>. However it is beneficial to local economies to provide measures aimed at attracting more pedestrians and public transport users to the area rather than car users<sup>31</sup>. Retail and employment centres are significantly affected by the quality of their pedestrian environment, particularly in urban areas<sup>30</sup>.

Car drivers may spend more on a single trip to a retail area than walkers, cyclists and public transport users, however the latter groups tend to visit more frequently and spend more money over the course of a week than motorists do<sup>31 32</sup>.

Since the Green Light for Midtown project in New York retail rents have doubled in Times Square, new flagship stores have opened in the area which now contribute \$110 billion dollars in economic activity<sup>33</sup>. There has not been a significant increase in the amount of people using Times Square since the project was launched; rather it is the way in which the existing users are now using the space that has facilitated such economic windfalls<sup>34</sup>. This is illustrated by the fact that 84 per cent more people are staying (e.g. reading, eating, and taking photographs) in Times Square than before the projects inception<sup>31</sup>.

The measures introduced ensure that users of Times Square are no longer are pushed through the area by competing pedestrian flows. People now have time to enjoy the space, view the retail offerings and choose where they want to spend their money<sup>34</sup>. The



Figure 5 Before (left) and after (right) Pedestrian Changes in New York

midtown project has “shifted the paradigm for what a street and sidewalk experience is supposed to be like”<sup>31</sup>.

The economic value of window shopping cannot be underestimated. This can be seen both at Times Square and Great Queen Street in London where the area has been transformed from “a lacklustre junction in central London into a pedestrian oasis in the heart of the city”<sup>35</sup>.

The existing space in Great Queen Street has been greatly improved by increasing footway space for visitors to shop, socialise and relax in. By removing unnecessary street furniture and using innovative design the area has created room for window shopping. Pedestrian crowding has been judged to have fallen by 20% and the economic benefits are estimated to be between £6.3m and £28.4 m against an outlay of £2.4m.<sup>35 36</sup>

In the UK, investments that improve walking, cycling, and public transit typically increase retail sales by an average of 30 per cent and land value from 70 to 300 per cent.<sup>35 37</sup>

This increase in values can be observed at a local level. In 2008, after significant pedestrianisation and closure of the road to motor vehicles, the land value, capital value and rental value of properties in Swanston Street were the highest

*“Once you realise that you can use your streets to improve the quality of life, the economics and the environmental health of your city, I think that’s a transformative moment”  
Janette Sadik-Kahn*

of all the main streets the CBD. In 1990, before the Street's ongoing pedestrian improvement initiatives were initiated by partially closing the street to vehicular traffic, Swanston Street held only the fourth highest rental values<sup>38</sup>.

## Through block links

The city block is the fundamental element of the physical structure of urban areas. The physical permeability of a city is determined by the number and pattern of its public streets, lanes, alleys, arcades, squares, piazzas, parks, etc., which affect the ease with which people can access the area and move through and within it<sup>39</sup>.

A highly permeable network has many short direct links, numerous intersections, and minimal dead-ends<sup>40</sup>. As permeability of a network increases, travel distances decrease and route options increase, allowing more direct travel between destinations, creating a more accessible and resilient transportation system<sup>41</sup>.

Frequent streets and short blocks are a valuable asset to a city because of the fabric of intricate cross-use that they permit among the users of a city neighbourhood<sup>1</sup>. The advantages of short blocks and through block links is simple, frequent corners offer the pedestrian an increased opportunity to follow an alternate path. Increased nodes provide a greater total length of block perimeters within the same area than larger blocks, which in turn provides a significantly greater number of small retail opportunities<sup>42</sup>.

A prime example of a highly permeable network grid is that of Portland, OE.

Portland's dense grid is laid out in 60.96m x 60.96m blocks which offer the pedestrian a plethora of options for traversing the city on foot. Within a

reference area of 800m x 800m the initial layout of Portland had 110

intersections compared to Melbourne's 28. However the number of intersections that Melbourne now possess has significantly increased due to the erosion of the large city block into smaller subdivisions and laneways<sup>42</sup>.

Long street blocks are inconvenient for pedestrians<sup>43</sup> as they have a coarse circulation mesh, they automatically sort people into paths that intersect far too frequently so that users of the same geographical space are literally blocked off from each other<sup>1</sup>. These routes arrive at main streets which tend to lend to the dominance of commercial standardization, they offer little street frontage on which commerce can thrive, opening up large blocks with the provision of through block links or shorter block sizes would considerably increase the feasible area for commerce<sup>1</sup>.

A greater level of connectivity can provide for a more stimulating urban environment. The greater the degree of connectivity the greater the potential routes that are afforded to the pedestrian within the same physical area<sup>44</sup>.

These options create more places for commerce and for encouraging connections, and thus contribute to the social and economic life of an area<sup>1</sup>. This is articulated in figure 7 where an equivalent city area is carved into three different scenarios with three different levels of access. Each scenario allows the individual to move from point A to point B. When the permeability of the block is increased the amount of options available to the pedestrian increases. The same distance is travelled in all of the potential routes but the diversity in the routes increases exponentially when the permeability of the area is increased<sup>44</sup>. These locations provide a vibrant

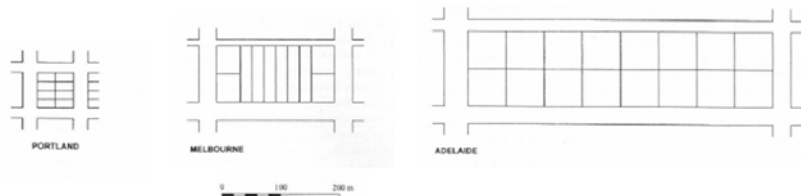


Figure 6 Portland Melbourne Adelaide Block Size comparison

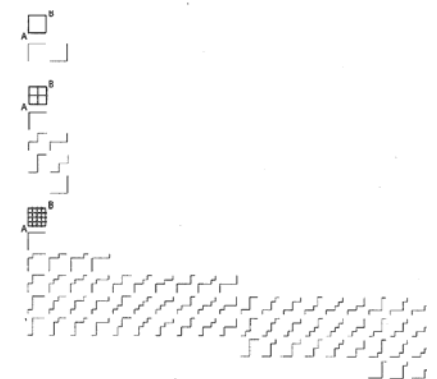


Figure 7  
44

lattice of connectivity<sup>45</sup> on which employment and economic activity can grow.

Shorter blocks work better for cities than larger blocks as they produce a finer-mesh circulation patterns, more lot frontages, more coherent block fabrics and finer grained continuous urban fabrics, both with low-rise and high rise buildings<sup>42</sup>. This is particularly evident in Melbourne where the initial city blocks have evolved to such an extent that 240 lanes are now present within the initial block structure. The number of intersections affording change in travel direction is a good indicator of the level of pedestrian connectivity<sup>46</sup>.

Cities with large blocks such as Adelaide have been considerably altered from their original layout time by the addition of streets and alleys creating smaller blocks and sub blocks. Cities such as Melbourne with a medium sized block have been partly modified from their original form. The addition of these streets, alleys, arcades and pedestrian systems has altered the initial circulation mesh of the original patterns providing pedestrians with an increase variety of choices through and around the permeable nature of the evolving blocks. Cities with small blocks, such as Portland, have undergone very few changes therefore can be regarded as having the optimal block size<sup>42</sup>. Figure 8 illustrates the changes of the original block form in Portland which has small blocks against Melbourne which has larger Blocks.

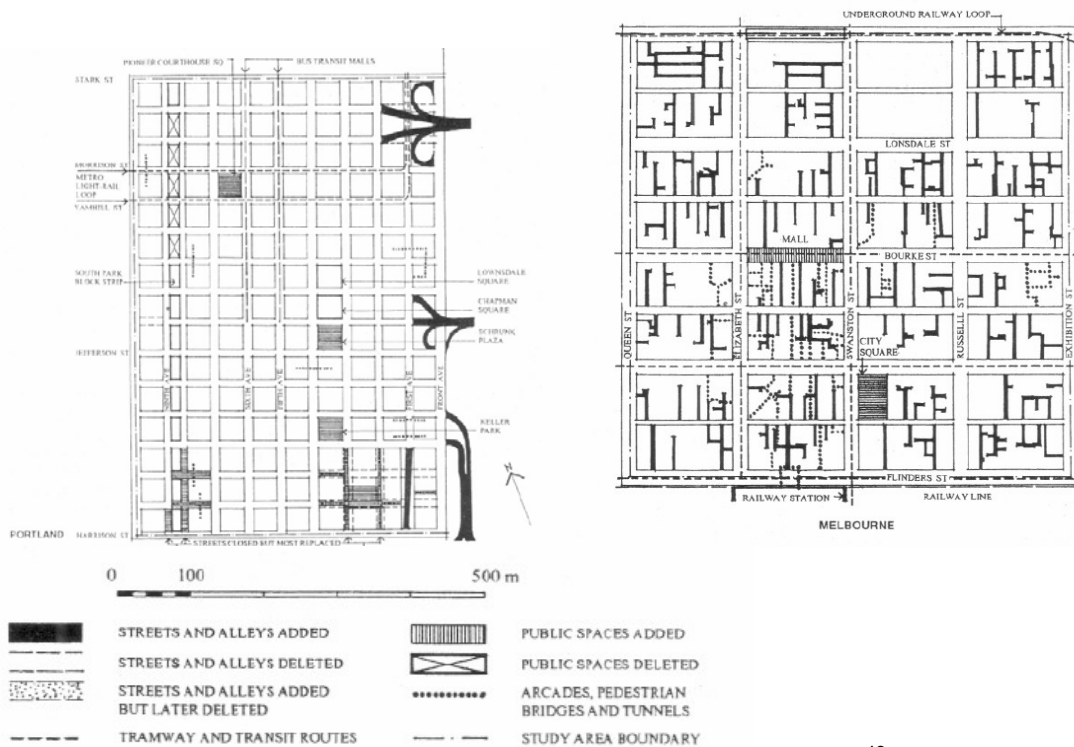


Figure 8<sup>42</sup>

### Optimal block size

Blocks of 200m have a coarse circulation pattern which is unsuitable for pedestrian circulation and movement. Blocks of 80-110 m offer a circulation mesh that is convenient both for pedestrian and vehicular movements. Finer mesh networks of 50-70m are highly appropriate in areas of intense pedestrian activity particularly in retail core blocks. Figure 8 articulates block sizes, Melbourne is shown in grey 200m x 95.5m.

Melbourne's central city has a morphology based on a grid shape, in which every block has alleys or laneways that are a rich lattice of nodes harbouring a thriving and diverse economic activities. Totalling some 240 lanes, streets, arcades, places and alleys, these through-block

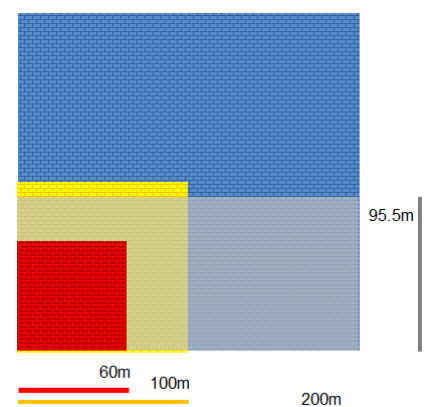


Figure 9

links serve as important north-south connections, expanding the city's pedestrian network while supporting the formal structure of the grid<sup>47</sup>.

These laneways house restaurants, small shops, cafes, social innovation spaces, studios residential accommodation, murals and street art installations. The laneways act both as a route and a destination they are the hallmark of modern Melbourne and they offer vibrancy where once there was none.

Redevelopment of Melbourne's laneways has contributed immeasurably to the character of the city centre as a dense and lively area for multiple activities. The laneways therefore support sustainable inner city development by allowing retention of heritage streetscapes to coincide with increased residential density and better use of space<sup>47</sup>.

The increase in pedestrian activity and improved amenity due to the opening of laneways for public use encourages new businesses to open up. Increasing availability of outdoor dining generates increased economic expenditure. This flows into increased business viability and increased job creation<sup>48</sup>. The economic activity is estimated to range between \$14,000-\$25,000 per square metre per annum. This is the revenue range that can be generated by a typical café. This figure doesn't include the multiplier effect of additional employment<sup>48</sup> If the walking connectivity within the CBD — grid was reduced by 10 per cent, the value of the economy of the CBD grid would be reduced by \$2.1 billion. This represents a 6.6 per cent reduction in the value of the economy<sup>45</sup>.

## Current Council policy on Shorter blocks

The Arden-Macaulay Structure plan 2012<sup>49</sup> aims to improve the walking environment of the area by ensuring “a compact urban structure with intersections at least every 50-100m”. The Plan aims to improve permeability of the public realm by introducing a finer grain network of streets and laneways. Laneways are to be accessible to pedestrians and cyclists 24 hours a day. The plan ensures that the maximum distance between intersection is

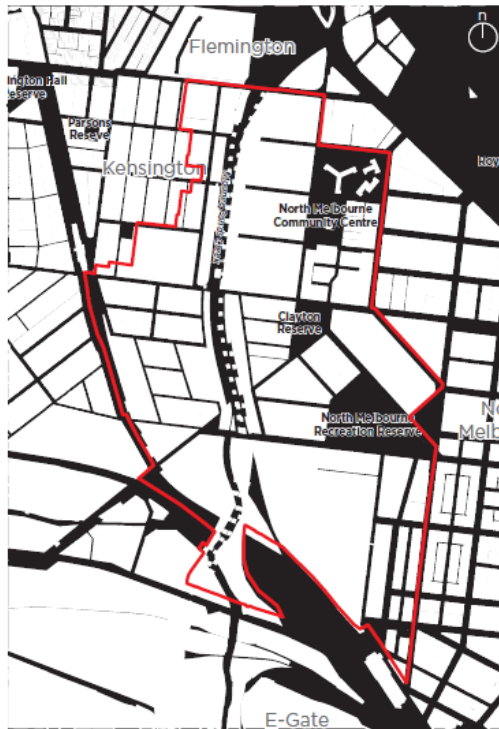


Figure 3.7: Existing pedestrian permeability as indicated by extent of the public realm (black).



Figure 3.8: Proposed pedestrian permeability as indicated by extent of the public realm (black) - with new parks, streets and laneways shown.

Figure 10<sup>49</sup>

100m. Figure 10 illustrates the increased permeability of the network in the Arden-Macaulay area. Planning scheme amendments C171, C190, C196 which are in the process of being adopted also make provisions for short blocks and increased permeability.



## Key findings and highlights

Our footpaths are both a route and a destination. There are two different types of pedestrians that use our streets, Browsers and Commuters.

These pedestrians take part in three different kinds of activities on our streets. Necessary activities take place regardless of the physical surrounding. People tend “hurry home” when they are provided with poor quality streets. Optional and social activities only occur when the physical environment is of a high quality.

An overcrowded street is a sign of a poor quality walking environment. Walking turns into a fight when overcrowding occurs. A pedestrian’s ability to select their own walking speed is a fundamental requirement of a pedestrian facility. Overcrowding has an adverse effect on the ability of a pedestrian to choose their own speed, “As volume and density increase, pedestrian speed declines”.

Pedestrian signals if poorly operated can create unnecessary delay, Pedestrian delay and non-compliance go hand in hand, a study of pedestrian crashes at crossing facilities in New South Wales and Victoria found that illegal pedestrian movements featured in 32-44% of pedestrian crashes at signalised intersections.

Research universally indicates that pedestrians’ impatience and risk taking behavior significantly increases after 30 seconds of delay. The reduction of unnecessary delay for pedestrians would result in encouraging pedestrians to use crossings correctly and reduce risk taking.

Excessive delays at busy intersections causes increased groupings of pedestrians in Platoons. These platoons of pedestrians move along a block until they encounter another platoon of pedestrians which triggers a highly undesirable series of stop starts, changes of trajectory and speed by both sets of pedestrians. This conflict between bi direction flowing platoons has a highly undesirable consequence; it curtails the use of the footpath for social activities and turns the footpath into a crowded pedestrian route.

Overcrowding has a negative effect on commerce, optional and social activities, those with special needs, road safety and encouraging people to walk.

Improving the pedestrian realm can bring significant economic benefits, the economic value of window shopping cannot be underestimated. Since the green light for midtown project in New York retail rents have doubled in Times Square. There has not been a significant increase in the amount of people using Times Square since the project was launched; rather it is the way in which the existing users are now using the space, This is illustrated by the fact that 84 per cent more people are staying (e.g. reading, eating, and taking photographs) in Times Square than before the projects inception.

By removing unnecessary street furniture and using innovative design in Great

Queen Street London pedestrian crowding has been judged to have fallen by 20% and the economic benefits associated with the changes are estimated to be between £6.3m and £28.4 m against an outlay of £2.4m.

A highly permeable network is a valuable asset to a city because of the fabric of intricate cross-use that permeability permits among the users of a city. Long street blocks are inconvenient for pedestrians as they have a coarse circulation mesh, Shorter blocks work better for cities than larger blocks as they produce a finer-mesh circulation patterns, more lot frontages, more coherent block fabrics and finer grained continuous urban fabrics. It was found that finer mesh networks of 50-70m are optimal areas of intense pedestrian activity particularly in retail core blocks. Cities with larger blocks than the optimal block length tend to evolve from their original form to become more permeable with the passage of time.

## References

---

- <sup>1</sup> Jacobs J 1961, *The death and life of great American cities*. Random House, New York.
- <sup>2</sup> Davies S, 1982 Designing effective pedestrian improvements in business districts, PPS, Usa
- <sup>3</sup> COM. 1988. Melbournes Pedestrain Heart The lanes. Melbourne
- <sup>4</sup> Aecom, 2011, Economic evaluation of pedestrian improvements. Sydney
- <sup>5</sup> Gehl J, 1987 *Life between buildings*, New York Van Nostrand Reinhold
- <sup>6</sup> Roberts S, 2011. *You Like Walking in the City? So Do Plenty of Others*. New York Times. Viewed 12<sup>th</sup> April 2012, <http://cityroom.blogs.nytimes.com/2011/12/06/you-like-walking-in-the-city-so-do-plenty-of-others/>
- <sup>7</sup> Gehl Architects, 2008 World Class Street; Remaking New York Citie's Public realm, New York
- <sup>8</sup> PUSHKAREV B and ZUPAN J, 1975 *Urban Spaces for Pedestrians*. MIT Press, Cambridge, Mass
- <sup>9</sup> Loukaitou-Sideris & Ehrenfeucht R, 2010. Vibrant sidewalks in the US. Access Magazine, UCTC. California
- <sup>10</sup> Gehl Architects, 2004, Towards a fine city for people, London
- <sup>11</sup> Gallin, N. (2001) Quantifying Pedestrian Friendliness – Guidelines for Assessing *Pedestrian Level of Service*. Presented at Australia: walking the 21<sup>st</sup> Century.
- <sup>12</sup> Fruin J, 1971, *Pedestrian Planning & Design*. Metropolitan Association of Urban Designers and Environmental Planners. New York
- <sup>13</sup> Healthy spaces & places, 2009, *Connectivity and Permeability*, Viewed on 2<sup>nd</sup> of April 2013 <http://www.healthyplaces.org.au/userfiles/file/Connectivity%20June09.pdf>
- <sup>14</sup> DOT Western Australia, 2011, Planning and designing for Pedestrains
- <sup>15</sup> Fitzpatrick Et al, 2006, Improving Pedestrian Safety at Unsignalized Crossings, NCHRP
- <sup>16</sup> NYC, Dept of city planning, 2006, *Pedestrain Level of Service study*.
- <sup>17</sup> Lopez A, 2006, Assessment of measures to ease pedestrian congestion. Association for European transport
- <sup>18</sup> Munro C, 2007, *City pedestrians not walking, waiting*. Sydney morning herald. Viewed on 13<sup>th</sup> April 2013 <http://www.smh.com.au/news/national/city-pedestrians-not-walking-waiting/2007/09/10/1189276633566.html>
- <sup>19</sup> Daff R, Et al 1991, *pedestrian behavoir near signalised crossings (sydney)*. Proceedisngs 16<sup>th</sup> ARRB conference, Part 4
- <sup>20</sup> Asaba M & Saito T, 1998 *a study on pedestrian signal phase indication system*. Transport information and control, 21-23April 1998, Conference publicaion no 454
- <sup>21</sup> Baass K G, 1998, Review of European and North American practice of pedestrian signal timing, RTAC annual conference Calgary, Alberta.
- <sup>22</sup> Austroads, 2000. Pedestrian and Cyclist Safety – Pedestrian Crashes at Pedestrian Facilities, Report No.AP-R156, Austroads, Sydney
- <sup>23</sup> Kaiser, S. H. 1994, *Urban Intersections that Work: a New Definition for Level of Service*. In Transportation Research Record 1438, TRB, National Research Council, Washington, D.C.,

---

<sup>24</sup> CROMPTON, D. 1979. Pedestrian delay, annoyance and risk: preliminary results from a 2 years study. In Proceedings of PTRC Summer Annual Meeting, 275-299.

<sup>25</sup> Hunt, Lyon and Parker. *The operation and safety of pedestrian crossings in the United Kingdom*, Proceedings 17<sup>th</sup> ARRB conference part 5 p 49.

<sup>26</sup> Gårder, P., 1989. Pedestrian safety at traffic signals: A study carried out with the help of a traffic conflicts technique, *Accident Analysis and Prevention* 21(5), 435-444

<sup>27</sup> Hamed, M.M., 2001. Analysis of pedestrians' behavior at pedestrian crossings, *Safety Science* 38(1), 63-82.

<sup>28</sup> Sisiopiku, V.P., Akin, V., 2003. Pedestrian behaviours at and perceptions towards various pedestrian

facilities: an examination based on observation and survey data. *Transportation Research Part F* 6(4),

<sup>29</sup> Anon, 1975, *Measures in favour of pedestrians*, centre d'Etudes des Transports urbains, Arcuiet, France

<sup>30</sup> Litman T, 2011, *Economic value of walkability*, VIC transport policy institute.

<sup>31</sup> Tolley R, 2011, Good for business: The benefits of making streets more walking and cycling friendly

<sup>32</sup> Badger E, 2012 Cyclists and Pedestrians Can End Up Spending More Each Month Than Drivers, *The Atlantic*

Cities Viewed on 14<sup>th</sup> April 2013

<http://www.theatlanticcities.com/commute/2012/12/cyclists-and-pedestrians-can-end-spending-more-each-month-drivers/4066/>

<sup>33</sup> NYC DOT, 2010, Green light for mid town evaluation report

<sup>34</sup> Gehl J, 2013. *Pedestrian overcrowding* Email correspondence DM : 7832093

<sup>35</sup> TFL, 2010, *Pedestrians come first in the West End as £2.4m improvements to new walking route completed* <http://www.tfl.gov.uk/corporate/media/newscentre/archive/14113.aspx>

<sup>36</sup> Long T, ????, Great Queen Street, London, A best practice walking scheme that increased property values

<sup>37</sup> CABE, 2007, Paved with gold. The real value of good street design

<sup>38</sup> Council report agenda item 6.2 31 March 2009

<http://www.melbourne.vic.gov.au/aboutmelbourne/projectsandinitiatives/majorprojects/swanstonstreet/documents/attachment1swanstonstreetasnapshot.pdf>

<sup>39</sup> Auckland Council (????) Annex 2

<http://www.aucklandcity.govt.nz/council/documents/central/pdfs/annexure02b.pdf>

<sup>40</sup> QDL Transport, 2007, (Qtips) planning for movement network

<sup>41</sup> Victorian Transport policy Institute, 2012, Roadway Connectivity Creating More Connected Roadway and Pathway Networks

<sup>42</sup> Siksna A, 1997, The effects of block size and form in Australian city centres.

<sup>43</sup> Change lab solutions, 2013 Pedestrian Friendly Code Directory: Short Street Blocks <http://changelabsolutions.org/childhood-obesity/short-street-blocks>

<sup>44</sup> L Hodyl, Catchments Parametric Urbanism Studio

<sup>45</sup> SGS, 2013, CBD Pedestrian Analysis, Melbourne.

---

<sup>46</sup> Kusumo C, 2005, Living working shopping in Delft Central Station. ISoCaRP congress

<sup>47</sup> Gehl Architects, Places for People Melbourne

<sup>48</sup> Tivendale Transport Consulting, 2012, *CBD Share Zones Melbourne*

<sup>49</sup> COM, 2012, Arden-Macaulay Structure Plan