Connectivity and Permeability

Definition

Connectivity (or permeability) refers to the directness of links and the density of connections in a transport network. A highly permeable network has many short links, numerous intersections, and minimal dead-ends. As connectivity increases, travel distances decrease and route options increase, allowing more direct travel between destinations, creating a more accessible and resilient transportation system (TDM Encyclopedia, 2009).

Melbourne's laneways provide excellent permeability of the CBD
Source: Booz & Co

Overview

Connectivity affects the degree to which transportation networks such as streets, walking and cycling paths, connect people to their destinations (including intermediate destinations such as public transport services). Good connectivity provides easy access to key destinations for pedestrians. Excellent connectivity actively seeks to discourage car use by making local trips easier and more pleasant by foot than by car.

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Transportation activity (walking or cycling) is positively associated with number of destinations and public transport and perceived access to bike lanes near home (Hoehner et al., 2005). In addition, the presence of well-maintained footpaths is associated with walking for recreation and for transport (Pikora et al., 2006).

The type and density of intersections in the network (not just those for cars) has a significant impact on how people move around, whether by foot, bike, public transport or car (Gebel et al. 2005). A less permeable network has few intersections making it difficult to reach a destination in a reasonably direct route, and using a number of different routes between point A to point B (Frumkin et al., 2004). Destinations in areas with a well connected path network are easier to reach, than those in areas with a less connected path network.

The diagram below shows a ten minute (800 metre) pedestrian catchment (often referred to as a ped-shed) in an area with a connected street network (left), compared with an area with a less connected street network (right). The diagram indicates the dramatic difference in catchment area between the two neighbourhood types.

800m radius walk in a compact neighbourhood

800m radius walk in a sprawling suburb

Source: Walk Score http://www.walkscore.com/walkable-neighborhoods.shtml
Map courtesy of Lawrence Frank & Co. and the Sightline Institute.

When combined with mixed use planning (see separate Fact Sheet), a permeable path network significantly increases the opportunities for residents to walk to undertake daily tasks, rather than drive. Studies have proven a link between network connectivity and use of active transport or car dependence (LUTRAQ, 1997; Kopelman et al, 2007).

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The Land Use Transportation and Air Quality (LUTRAQ) study for Portland, Oregon showed that the odds of someone reporting that they walked for non-work purposes rose by 14 per cent for each quartile increase in the level of street connectivity where they live (King County ORTP 2005).

Increased connectivity (combined with increased density, mixed use planning and good urban design) = increased walkability = better health

Many people refer to 400 metres being a "reasonable" distance for people to walk. This stems from United States research in the 1960s. The purpose was to consider walking distances to public transport facilities. A "reasonable" walking distance is likely to be affected by location, topography, weather, pedestrian facilities, trip purpose and cultural factors. While a five minute walk (the time taken for the average person to walk 400 metres) may seem like a reasonable benchmark, it will not provide for a person's daily exercise needs alone. More recent studies have shown that people are willing to walk much greater distances if the walking environment is favourable (an average of 1.2 kilometres in good conditions).

Street networks can make pedestrian movement easier than car movement.
Source: Booz & Co

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The Health & Planning Link

A number of reviews have examined the relationship between neighbourhood walkability (including urban sprawl) and various measures of weight status (such as the Body Mass Index,). These show a positive relationship between living in urban sprawl and higher body weight (Robertson-Wilson et al., Papas et al. 2007, Black & Macinko 2008, Booth et al. 2005).

Being overweight or obese is associated with living in areas with low population densities, curvilinear street networks, limited pedestrian access to commercial facilities and high dependence on cars to travel from place to place (Frumkin H, Frank L & Jackson R, 2004).

How to achieve?

- Provide a grid path network - Spacing of pathways should optimise pedestrian movement and discourage car movement such as the use of cul-de-sac roads with pathways to enable pedestrian only access to the next street;
- Plan new subdivisions based on pedestrian and cyclist movement in the first instance before then "fitting" the road network into the plan;
- Retrofit existing subdivisions by closing road space (particularly one leg of cross intersections) while retaining cyclist/pedestrian paths (this makes pedestrian movement safer and more attractive while also improving vehicle safety at these intersections);
- Provide footpaths on both sides of all streets except where the road surface is so narrow that cars are expected to share the space with pedestrians.
- Provide local employment, recreation and retail facilities;
- Increase residential densities to support additional localised facilities (Over 30 dwellings per hectare will sustain a basic level of facilities within walking distance);
- Ensure pathway networks connect with arterial networks to travel longer distances (particularly relevant for cycle use);
- Australian Standard 1428 Parts 1 & 2, Part 13 AustRoads *Guide to Traffic Engineering Practice: Pedestrians*, sets a minimum standard footpath width of 1.2m as adequate for most road and street situations except in commercial and shopping environments, where pedestrian demands and accident risk may require wider paths.

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Space has been made to protect cyclists in Melbourne's network
Source: Booz & Co

Rule of Thumb
On average people are willing to walk one kilometre to reach a functional destination. This is dependant on many factors including topography, weather and the walking environment including directness of the route. By providing path connections around every 100 metres a suburb will be highly permeable and more likely to encourage pedestrian trips. Where major barriers (such as creeks and railway lines) make connections expensive to provide, the network should confluence around fewer crossing points spaced around 500 metres apart.

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Encourage

- Highly interconnected path network providing choice of walking and cycling routes that lead to local and regional destinations
- Limited road space to encourage slower traffic speeds and higher pedestrian amenity;
- Limited road connectivity to encourage cars to use arterial roads rather than local streets and promote walking as the local trip mode;
- Closure of existing roads while maintaining pedestrian access to increase pedestrian and vehicular safety by removing unsafe intersections;
- Parking on street (rather than indented bays) to slow vehicle speeds;
- Improved pedestrian and cyclist safety through the provision of safe street crossings (See Safety and Surveillance and Active Transport Design Principles for further information).
- Require raised pavement crossings on all side streets in retail environments and any other location where pedestrian safety is an issue (such as left turn slip lanes);
- Install way-finding signage that utilises heads-up displays;
- Narrow road widths to increase pedestrian crossing opportunities and reduce vehicle speeds; and
- Construction of complete arterial and collector road networks early in the subdivision process to enable bus routes to commence in their optimal (long term) form.

Avoid

- "Gated" communities as they restrict walking and cycling access and reduce the connectivity and connectivity within and outside the local street network
- Land uses, subdivision and design features that act as physical barriers and impede access to key destinations
- Cul-de-sacs except where pedestrian access is provided to link with other streets
- Delaying construction of walking and cycling paths in new subdivisions, as transport habits are difficult to change once established.
- Use of roundabouts (prohibit them in retail and high pedestrian volume environments).

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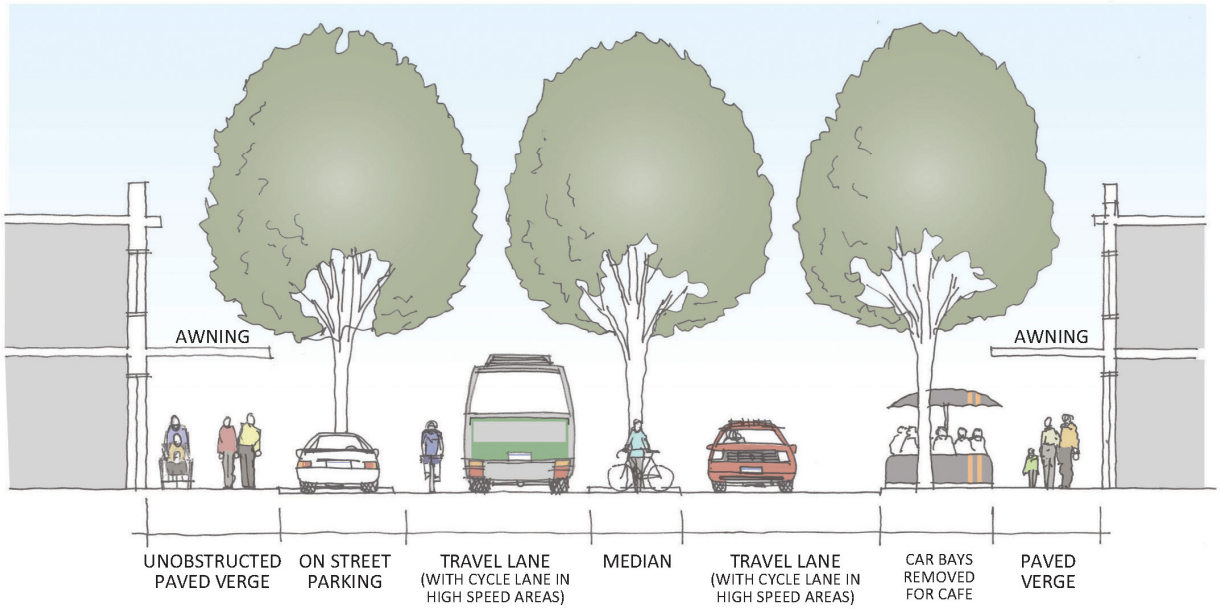
STREETS

A street with well defined edges, sufficient pavement width, shade for pedestrians and strong vertical elements to encourage reduced traffic speeds.



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