

Connectivity

Fact Sheet by Peter Cotton posted 29 May 2008

Achieving high connectivity within and between neighbourhoods and linkages to surrounding areas is one of the many objectives to make for a more livable and sustainable estate. This fact sheet discusses the considerations and influencing factors that planners and designers need to take into account when designing an estate to achieve high connectivity.

•Categorised under:

- Estate Design,
- Developer,

Introduction

Connectivity is created via the circulation and movement systems including vehicular, pedestrian and cyclist that link the various elements of land use: local activity centers, open space reserve and parks, schools, community facilities, unique site features, local landmarks, view opportunities etc., as well as connections to the immediate surrounding developments and wider areas. The pattern of these movement systems and the design of street layout have a major influence on the level of connectivity of an estate, as is permeability of the neighbourhoods.

| Connectivity Considerations | Influences |
|---|--|
| External linkages/integration | Surrounding patterns of development “ existing/proposed |
| Connecting neighbourhoods | Size of development “ number of neighbourhoods |
| Connecting open space systems | Visual and physical links |
| Connecting unique site features, landmarks, views opportunities | Visual and where appropriate physical links |
| Street pattern | Network versus treed/ hierarchical structure for better connectivity |
| Street block sizes and dimensions | Permeability Distances between intersections - speed control |

| | |
|-----------------------------------|--|
| Interconnected movement corridors | Locations of activity centres, social, cultural, educational, sporting, recreational facilities Public transport routes Pedestrian and cyclist desired lines |
| Safety and security | Passive surveillance opportunities along movement corridors, open space links, parks |

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External linkages and integration

Residential estates or neighbourhoods do not exist in isolation. They are linked to the immediate surrounding and wider communities via connecting movement corridors. In principle, new developments need to be integrated into the surrounding urban fabric to facilitate interactions and encourage cross communications between estates. Depending on whether it is a greenfield, brownfield or infill development, opportunities for linking into the existing movement pattern may vary. Also, there may be site constraints or physical barriers that prevent cross linkages between estates from happening. On the other hand, for land-locked sites with limited opportunities for external linkages, the feasibility of purchasing parcels to open up additional links should be investigated. The cost of the purchase of lots could be offset against monetary contributions such as Section 94 Contributions in NSW. Needless to say, linkages and integration with surrounding developments only need to occur if it is desirable and advantageous to do so. If doing so is to the detriment of the proposed estate, as in the case where surrounding developments are of incompatible uses, of obnoxious character and visual blight, linkages and integration should not be enforced.

*Image: External Linkages and integration
Newington, by HPA, Cox Richardson & PTW, 1996.*

Connecting neighbourhoods

Depending on the size and scale of development, an estate may contain a number of clearly defined neighbourhoods that are connected together via neighbourhood connector roads. For large scale developments, these roads would also accommodate bus routes servicing the neighbourhoods, as well as cycle paths and footpaths. These roads provide the primary inter-neighbourhood connections. Secondary and local level connections can also occur across neighbourhood defined edges, the frequency of which depends on whether these edges are made up of natural reserves, bush or riparian corridors, or roads separating the neighbourhoods. Where it is not appropriate to have vehicular connections, pedestrian and cycle paths that connect desired destinations should be provided to improve connectivity.

Image Source: Liveable Neighbourhoods, Western Australian Planning Commission

Connecting open space systems

The public open systems should be designed to be linked together either via an open space corridor, linear park and the like, either deliberately created for the purpose of following existing natural features such as bush corridors, riparian zones, significant vegetation communities etc, or via movement corridors widened to accommodate sufficient green verges or median strips to make the green links more legible. Linking open spaces enables uninterrupted flow of movements between them for pedestrians, cyclists, as well as animals, and makes the effective combined area of open spaces more sustainable for the development of a local eco-system and biodiversity.

For best practice, public open spaces should also be edged with a public road to provide ease of access for their use and management, as well as allowing lots to front them for visual amenity and casual surveillance. Connectivity from residential and other areas can be enhanced by directing streets towards the open spaces, if orientation, topography and other constraints are not an issue.

Connecting unique site features, landmarks, view opportunities

Sites that have unique features, land marks, view opportunities etc should take best advantage of these assets by highlighting, celebrating and providing ease of access to them. This can be done by designing a layout that locates these features in prominent locations in the street network system and where possible, orienting streets towards them, and using streets to link them.

Street pattern

Street pattern has a major influence on the connectivity of neighbourhoods. The conventional loop and cul-de-sacs pattern based on a "tree" or "dendritic" structure provides poor connectivity and limited choice of movement routes. On the other hand, a street pattern that is based on a "network" provides much higher connectivity and increased choice of pathways for movement and circulation.

In an ideal situation on a flat site with no other constraints, a grid network of streets would impart the maximum benefit for connectivity and efficiency of movement and circulation. The straight streets that form the grid network are also conducive to being used for view corridors where visual connections are important.

Where grid network patterns can't be achieved due to factors such as hilly terrains and jagged topography, the network can be modified to accommodate the topographical variations, while maintaining the interconnectedness, although the opportunities for creating view corridors for visual connections are lost.

Street block size and dimensions

The grain of neighbourhoods or its permeability is determined by the street block sizes. The smaller the street blocks, the more permeable the neighbourhood becomes, and vice versa. High permeability resulting from

reduced street block lengths increases connectivity and enhances the walkability of a neighbourhood, thereby encouraging walking and cycling. It is important therefore, in the design and layout of streets and lots, to ensure that block sizes are kept small to make neighbourhoods more permeable with improved connectivity.

Source: Liveable Neighbourhoods, Western Australian Planning Commission

Interconnected movement corridors

The street network and movement corridors should provide the shortest, most efficient and direct routes to activities and important destinations to encourage walking and cycling. The routes should follow the desired lines and be clearly legible and their function readily understood. They should be interconnected to increase choice of paths to multiple activities and destinations such as activity centres, social, cultural, educational facilities, open space, sporting and recreational activities etc. Public transport routes should also relate to nodes of activities to complement pedestrian and cyclist connectivity and encourage less use of private vehicles.

Source: Liveable Neighbourhoods, Western Australian Planning Commission

Safety and security

There is a relationship between connectivity and the level of safety and security in a residential estate. High connectivity generally implies an interconnected network of streets and circulation systems with high permeability and high level of accessibility to activities and places. It also implies higher propensity for pedestrian and cycling modes of transport with a consequent reduction in use of private vehicles. Fewer cars on the streets means less potential for accidents and increased safety for pedestrians and cyclists, as well as occupants of vehicles. More pedestrian friendly streets means more people are likely to use them with increased possibilities of chance social encounters and interactions. The presence of people and activities on streets and easily accessible public open spaces, coupled with casual surveillance from dwellings fronting them reduces the likelihood of anti-social activities or opportunistic crimes being perpetrated.

Source: Urbanism, Environment and Health Conference 2006, Sustainable Development and Urban Planning - Sharing the Agenda towards more Active and Healthy Communities, Wendy Morris.

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Source: Practice notes AMCORD

Key Issues

Benefits

High connectivity which comes with an interconnected network of streets and circulation systems provides benefits of:

- Ease and convenience of access to activities
- Short and direct routes encourages walking and cycling and less use of private vehicles resulting in improved air quality, improve fitness and health of residents engaging in active pursuits of walking, cycling, recreational activities in linked open space systems
- Increased chance social interactions and development of social harmony
- Improved safety and security.

Risks

The main risk associated with providing high connectivity is increased costs of maintenance by council. It is a possibility that council may not be able to maintain the verges, pathways and open spaces to the level that is attractive to users and residents, resulting in reduction in patronage and disuse. This can then adversely impact on the overall environmental quality of the estate, as well as posing a potential threat to being used for anti-social activities.

Savings

High connectivity provides ease and convenience of access to activities which encourages walking and cycling, and consequent reduction in use of private vehicles. When combined with the benefit of a compact neighbourhood, high connectivity results in savings in:

- fuel costs from reduced private car uses
- time for travel
- health care costs due to better fitness and health from engagement in active pursuits such as walking, cycling and recreational opportunities in parks and open space, and from better air quality.

Costs

Providing high connectivity involves higher provisions of streets and circulation systems, hence higher costs than conventional development, although the extra costs are offset by general reduction in widths of roads. There are also extra costs associated with increased numbers of dedicated pathways for pedestrians and cyclists, which need to be attractive and safe to use.

Barriers

The main barriers to achieving high connectivity are costs. The other barrier is council engineer's dislike of cross intersections which come with providing a network pattern of streets. The conventional loop and cul-de-sacs,

dendritic pattern of streets produce few cross intersections and is still favoured by some councils. Reduction in widths of roads, which comes with compact neighbourhoods to make streets more pedestrian friendly, reduce speed and improving the environmental quality of the 'out door communal rooms', also meets with resistance from engineers.

Benchmarks

There are no known benchmarks to measure connectivity. There are guidelines and performance requirements, often couched in street design and layout terms, but no specific measures articulated. The closest to any measure related to connectivity is the guidelines on block sizes and distances between street intersections, which determine permeability and indirectly impact on connectivity.

Development phase actions

Feasibility

Achieving high connectivity has implications during the financial feasibility stage due to increased costs resulting from having a higher proportion of streets and pathways, and reduction in yields to open up visual and physical links. In some instances where links to the site are limited, the possibility of opening up more links to the surrounding environment via land swaps or outright purchase may need to be investigated.

Planning

Planning involves identification and analysis of linkages and connections to activities and places within and between developments, internal and external, to determine how to achieve high connectivity, not only for vehicles, but also for pedestrians and cyclists.

- Identify existing and future external movement corridors providing access to the site, including pedestrian and cycle paths.
- Determine desired linkages to surrounding developments and integrate the proposed development to the surrounding area via alignment of internal roads and pathways with external connections (if integration is desired).
- Analyse and map out desired lines and the most efficient connections to activities within the estate, taking into consideration constraints such as steep topography, natural and man-made barriers etc; and opportunities such as links to unique site features, landmarks, views etc.

Design

Design for connectivity involves design of movement and circulation systems, which is part and parcel of the design of street and lot layout and the overall layout of an estate. The keys to achieving good connectivity within an estate design are:

- Integration and linkages to surrounding urban fabric
- Maximizing connections within and between neighbourhoods
- Maximizing connections to a linked public open space system
- Connecting to unique site features, landmarks, views opportunities
- Adopting a network street pattern
- Increasing permeability by designing layouts with small street blocks with short lengths and higher frequency of cross streets
 - Providing the shortest and most direct routes to activities and important destinations, interconnected to maximize choice of routes to multiple destinations.

Providing links and connections on plan is only part of the process to achieve connectivity. These connections need to be attractive, feel secure, well shaded and properly landscaped to attract patronage and encourage use.

Construction

During construction, do not expect to achieve full connectivity. With large scale developments, construction usually takes place in stages; and roads and pathways only offer limited connectivity. Stage construction so that each stage has some sense of completeness, with sufficient activities connected to the residential components to enable new residents to experience and enjoy the benefits and features of the new neighbourhoods.

Lot Creation

During lot creation phase, the issue of connectivity has already been resolved.

Completion

Some time after the completion of the development, review to check if all streets and movement corridors and pathways function as expected, and that there aren't any blockages or unanticipated frictions. Monitor the level of use and patronage of pedestrian and cycle paths and review to see if it can be improved. Also, assess the spatial and landscape quality of streets as 'communal rooms' provided by street trees, verge planting, median landscaping, street furniture and signage. Are there any issues requiring corrections or improvements? Are the dedicated pedestrian and cycle paths within the linked open space systems attractive and safe for residents to use?

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