05 August 2008

Jan McCredie

Group Manager: Urban Design

Manukau City Council

Living Streets Aotearoa   01/09/08

Double the Feet on the Street

Street Layouts for Walkable Cities – Empowering People

I first studied streets in 1970. I sat in a very hot (pre air conditioned) car in the western suburbs of Sydney. Here with perspiring brow, I watched how people used the streets, and here while studying for a Masters Degree in Architecture my love of streets (good ones) and my understanding of the importance of streets started. Later work built on these elementary but enlightening observations.

The first half of this paper outlines why straight streets, long streets and a grided street pattern empower people to walk as an everyday activity.

In speaking of a grid system – I am speaking about fully interconnected street patterns with a flat hierarchy of streets. This does not mean that every street is dead straight or that every street is fully continuous, nor that the grid is orthogonal.

Clearly even in the most connected city this is not the case. Topographical considerations, construction methods and uses influence the outcome. In medieval towns the street pattern is more organic. In Barcelona New Town 1800's the formal grid is spliced by the diagonals. Paris is based on radial streets with a fine grain of interconnected streets.

There is also a relationship between the street wall i.e. the buildings, the spacing of the buildings, the width of the streets, the size of the street blocks, the height of buildings and the topography. All of these influence walking distances and perceptions.

This paper focuses on layout and is not addressing architecture resolution, active frontages, length of frontages, parking codes, programming activities or treatment such as paving & lighting. These are secondary to the layout.

Treatments and uses can be modified over time to accommodate changes however, if the basic layout is wrong. There are huge health, social and economic implications. The cost to change a street position is extremely high.

The second part of this paper looks at ways in which non-walkable neighbourhoods can be retrofitted so that they are more walkable. It makes the distinction between the traditional i.e. pre WW2 neighbourhoods and the more recent culs-de-sac neighbourhoods, colloquially known as "dead worm" or "spaghetti" subdivisions.

Comment is also made on the use of grids in the "new urbanist" and "smart growth" developments.

Why the street layout matters

Street patterns are the key to creating successful walking areas. No amount of education and traffic calming can make people walk. If people cannot see where they are going, if they know

they are walking 300m in circles when in fact their destination is only 100m away, if the journey is repetitive and boring and if there are no choices, people will not walk.

Street layouts are therefore critical in the design of cities.

Urban areas are made up of 3 main components: space, topography and buildings. Of these three, space is the organising element and of the space in a city, 80% is comprised of streets. So streets are 80% of the organising structure of a city.

Streets, because of their public nature and their relationship with other infrastructure, remain in place for literally thousands of years. Additional streets may be added – New York is currently attempting to introduce new streets and break up large street blocks, but fundamentally the streets of 2000 years ago still form the basis of cities e.g Beruit / Rome. It is therefore critical to get the layout right.

Since mankind was first vertical he / she has walked. For generations people have walked to farms, walked to war, walked to market. Even in the last 200 years people walked to shops, schools and public transport.

So what has changed centuries of human behaviour?

Clearly there have been numerous social and cultural influences in the last 50 years but the one that has most affected city planning has been the introduction of the car.

Prior to the arrival of the car, cities and towns were designed with street patterns that responded to the human condition. In particular they were designed for the way people see and the speed at which they moved i.e. by walking.

Why Grids are Great

How People See and How People Move

People see in straight lines – a very important fact. They have a view cone of about 70 degrees and sight lines are only about 1.5 metres above the ground less for children.

This means that people see:

- long distances over flat topography and along ridges and valleys

- shorter distances over hilly topography

- very slight differences in levels of topography

They cannot see:

- around curves and corners

- "through" objects.

Walking speed is relatively slow and traditionally people have wanted to walk directly to their destination in the shortest time.

These two characteristics how we see and how we move resulted in cities and towns being laid out in some manner of a grided street pattern.

In terms of movement – straight lines are the most direct way between two destinations. Multiple small street blocks provide the greatest number of ways to move through an urban and in the quickest time. Straight streets and grided streets offer clear sight lines, choice and the shortest distances.

So for centuries, urban areas developed with a grid of streets. These were laid over the land usually with ridge and valley roads linked by cross roads and bent to respond to the demands of the topography. Complete with small street blocks, the grided street layout produced an ideal response for people. As can be seen today in traditional cities all have a grid or a variation of a grid and it is no coincidence that these cities are the most walkable.

The grid minimised distances maximised choice and provided a clear reading of the topography.

Legibility, Identity and Variety

Legibility, Identity and Variety are related to:

- the spatial system (i.e. the streets in plan and in sections)

- the topography

- the architecture.

People cannot see over anything higher than about 1.5 meters off the ground but they can see very long distances along straight lines.

A contiguous mesh of relatively straight streets laid over the topography makes it possible to understand the land. Straight streets reveal the topography. People can read a "ridge road"; a street along the side of a hill - the "high side" and "low side"; the view down a street to a valley or to water. They can see views to mountains, views to water, and the shape of the land - even small changes in levels. This ability is a key to how people understand and navigate cities.

When streets are lined with buildings, people not only have the ability to read the topography, they can read "the space" of the street – a narrow or a wide street; a street lined with low buildings or tall buildings. i.e. a continuous row of buildings or a broken row. A definition in section of a street is an additional layer to the plan and contributes to both the identity of an area and the variety with an area.

Meeting

Grids have intersections - multiple corners. The smaller the street blocks, the larger the number or corners. Corners are wonderful not because of a buildings has two faces but because they are the intersection of two spatial systems. They provide "pause" points in the street fabric and they provide opportunities for "casual" meetings as well as the organised meeting place.

For generations people have met on corners - a clearly identifiable "place". The mobile phone may have changed the habit of the arranged meeting, but the possibility of meeting someone by chance is still an important part of city life. The greatest opportunity for this is where streets come together - the grid offers this opportunity.

Accessing grid patterns also maximise the number of entry points to "special" streets and / or plazas / town squares. For example, Tamaki Drive from Mission Bay to Saint Heliers. Large numbers of streets intersect with this harbour edge street. This is a highly popular walk and is used both day and night. It is not simply that it is a lovely walk; its success is partly due to its accessibility. The ability to see the walk at the end of the connecting streets and to join the walk at numerous places.

The same is true of successful squares, plazas and parks. Modern cities are littered with failed "squares". Changes to lighting and paving will not make a place work. The success of "places" and of edge streets within an urban fabric is intrinsically related to the number of connection points, and to whether there is a high level of visibility into those places.

The Campo in Sienna –one of the world's most successful spaces has approximately 13 entrances.

Apparent Density

Straight streets offer other advantages. Most streets are lined with buildings and people can see along them. Where the sight lines are clear the apparent density will be less than for the corresponding amount of building situated on curvilinear streets or culs-de-sac.

Where streets are truncated by buildings and / or are curved and / or where the buildings are set out at 45° to the street then the density of buildings will always appear greater.

This disempowers people. They can feel like they are in a maze and be overwhelmed by buildings – "the concrete jungle". They have lost the power given to them by being in a street in which the space is dominant, they are important and they can understand the land.

The straight streets revealed the topography and in so doing contributed to the legibility of identity and variety. The intersections created meeting places and the spatial system empowered people. So what happened?

The Impact of the Car

But then the car. The street layouts which offer the maximum advantages for people are precisely the ones which are perceived to be worse for cars. Because of this, post WW 2 subdivisions were set out in curves with culs-de-sac and a minimum number of intersections. This was to facilitate speed on the collector and arterial roads and to slow the car in culs-de-sac. These now very prevalent street patterns offer the pedestrian long journeys, less choice, poor sight lines and a much higher apparent density. Not surprisingly, studies in Britain reveal that people living in these neighbourhoods are on average 6lbs heavier than people living in traditional settings.

The very characteristics which make streets so good for people are the very characteristics which are discouraged in designing street layouts for cars. Straight streets encourage speed, multiple intersections slow traffic and result in more accidents, culs-de-sac are safe.

There are numerous factors which affect driver behaviour. Some physical, some cultural and some regulatory. The physical factors include the topographic impact on sight lines, the width of street and vehicle lanes, the alignment, street fences and speed signs. It is essential that in increasingly urban areas the movement of cars is curbed by means which doesn't disadvantage people. Projects in Europe have demonstrated conclusively that taking out all the elements which give power to the car such as traffic lights, fences, speed signs, "free"

lefts, accidents are lower, speed reduced but travel times unimproved. Cars and people can co exisit with appropriate design.

Making Finer Grids with Intensification

Improving Street Layouts Pre 1950 suburbs

The increased densities proposed for many older suburbs in New Zealand can present a wonderful opportunity to make these suburbs more walkable. So often, however, planning policies have allowed backyards to be stuffed with extra dwellings without understanding the enormous potential and the inherent relationship between street pattern and density.

Infill development provides a great opportunity to improve conventional grided suburban street layouts. Often these street blocks are based on large sections and are correspondingly large street blocks. Infill provides the opportunity to create a new finer grain of streets either at right angles to the main grid or parallel or both. In all cases, the street blocks are broken down to provide better accessibility, legibility and choice - i.e. more walkable neighbourhoods.

Where the sections are deep enough there is the opportunity to run new streets along the rear and to create new dwellings facing these streets. Where wide sections exist cross streets can be introduced bisecting blocks in the opposite direction.

Clearly there are issues related to implementation, but this approach to infill restructures the city into a more complex but legible city form.

This approach also reduces the number of long driveways. Given that NZ has the highest number of accidents in the world in driveways, this more strategic design approach has many advantages.

Organising infill in this way not only improves the city, it provides all houses with a street frontage and a rear garden. Gardens, solar access and privacy are not compromised and the existing subdivision pattern can be utilised to provide an optimum solution in terms of generous set backs and small street blocks together with multiple new streets. The same principle can be applied to parks.

In many open spaces, reserves and streams are located at the rear of dwellings. This makes them less valued and less safe. In this situation the introduction of new streets faced with dwellings can make the open space safer, more suitable for walking and offer better connections back into the street system once again improving accessibility.

What to do with "dead worms"?

A much harder task is the conversion of "dead worm" subdivisions. Characteristically "dead worm" subdivisions are based on a strict road hierarchy motorway arterial, collector roads and culs-de-sac. The roads are usually curved. The culs-de-sac short and numerous. Walking distances are long, straight lines are truncated by buildings. The apparent density is high due to the curvilinear nature of streets and the number of short dead end streets. Often dwellings back onto the open space reserves.

Because these neighbourhoods appear so much more dense infill can be problematic. Changing the street pattern is difficult and extremely expensive. In a recent exercise in Mangere, the cost for creating relatively few new street connections was $60 million.

The only real potential is to prepare a master plan to introduce as many connected streets and / or walk ways faced with dwellings as possible. Additionally density can be increased in places where they are closest to shops, transport and where they are less dominant within the street pattern.

One model of this, Radburn planning was introduced in Australia in 1960's and 1970's by the New South Wales Department of Housing. This model separated the road and the footpath, locating the footpath at the rear of dwellings and the road at the front. They were often, but not always, better connected than later street patterns. They were identified in (*The Single Detached House in the Outer Suburbs – A Case Study of the development process and resulting environment in our Estates in Sydney – Jan McCredie 1970*) as problematic and unsuitable for walking. Currently, they are being retrofitted to more closely align with conventional street and block patterns. This possibility was aided by the fact that the suburb is in single ownership.

Grids and Smart Growth

The success of the grided street and the failure of the non integrated street pattern has generally been recognised in most countries in the last couple of decades.

European cities have a higher percentage of their cities built with integrated street systems and since the 1970s have been reinforcing this approach in infill, new development or in retrofitting those developments built in the 1950's and 1960's.

The new urbanist / smart growth concepts developed in North America have reintroduced elements of grided street patterns. However, many of the smart growth developments in Australia use the grid as "pods" of grids rather than as a fully integrated mesh of urban streets.

The "pods" are either the result of a simplistic response to environment or transport considerations. Whatever the reason, they fail to replicate the real power and potential of a fully connected street pattern.

By studying the plans of traditional cities and the older parts of new cities, the extensive non broken nature of the street pattern is highly visible. The fabric of streets is only broken by natural features, rivers, harbours, mountains, parks etc. Transposing a grid as a stylistic response without a sense of its scale and the need for many long continuous and connected streets will not make more walkable cities.

The result of the smart growth approach is that the strength and robust nature of the continuous urban grid is lost. This includes the contiguous walking opportunities, the level of choice, the ability to read the topography and the potential success of retail areas, open space and town centres.

Conclusion

This paper argues that the connected grid with predominantly straightish streets provides the most successful street pattern in urban areas.

This is because it is fundamentally related to the human characteristics of seeing and movement. It sets up a spatial system which empowers rather than overwhelms; which reveals rather than conceals. It provides accessibility. legibility, identity and when complemented with an appropriate hierarchy - variety.

Cars are currently part of the world. They need to be accommodated but they should not be allowed to dominate and destroy urban areas. Streets are far too important to be designed primarily for the car. They have a role far beyond simply the movement of wheeled traffic.

Regardless of whether people are walking to the bus or the shop, whether they are walking for pleasure or purpose, given the same architectural and activity resolution, streets with a predominate number of long straight streets and with small street blocks will always offer people the most satisfying walking environment.

The street layout is the single most important element in an urban area. Unlike buildings, streets are in place for thousands of years. They have multiple functions and functions which change over time. Cars and drivers should be tamed in ways that don't jeopardise the quality of streets for people.