

EFFECTIVE LAND USE PLANNING FOR A SAFE SYSTEM

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1. A BRIEF STATEMENT OF THE ISSUE

Land use planning is much more than managing the location and density of residential development and the mix of uses (residential, retail, health, employment, education etc). The way in which new subdivisions and major developments are planned and designed has an impact across many spheres of life, including road safety. On existing road networks, the way the road system-land use interface is managed (e.g. through access control) also has a significant effect on road safety.

2. AN EXTENDED ASSESSMENT OF THE ISSUE

As part of the urban sprawl, many people live considerable distances from their place of work, from friends, relatives and other social contacts, from shopping facilities and from other services. Outer urban areas are often poorly serviced by public transport and this therefore leads to a strong dependence on private transport. Large retail outlets are usually constructed on a major route at the edge of town where land costs are lower, increasing the dependence on car travel.

In the middle suburbs there has also been a trend towards larger shopping and activity precincts. This has put pressure on the traditional neighbourhood corner shops, many of which have closed. This trend has also meant that people are travelling longer distances for services. Although public transport services are better in the middle suburbs, there is still a very strong dependence on private transport.

These trends all increase the need for travel, the time spent on the road system and therefore exposure to crash risk. Older people, and those who cannot drive are also disadvantaged by these trends. More effective land use planning has the potential to reduce this growth in need to travel and to manage the movement of pedestrians, cyclists and motorists in such a way as to reduce their exposure to crash risk.

The 'safe system' approach to achieving safe travel outcomes on the road network has been adopted by the Australian Transport Council. This approach assumes that if an alert and compliant road user makes an unintentional error, the transport system would be engineered in such a way that the errant driver will not suffer serious injury or death.

In terms of road safety, effective land use planning can be considered from two perspectives: issues associated with arterial roads and those associated with local roads. On arterial roads, more effective land use planning can be used to reduce the growth in the need for travel and hence reduce the risk associated with travel. The focus of a safe system approach should be on road (including intersections), roadside (including access management) and vehicle engineering safety standards and speed limits which together ensure for non-fatal crash outcomes for compliant road users.

On local roads the focus can be on both reducing the need for motorized movement and creating an environment that is more conducive and safer for non-motorized travel. The main dangers in local streets arise from excessive or inappropriate vehicle speed, inadequate road space, paths and crossing places for people on foot or riding bikes and poor traffic management at intersections.

3. A REVIEW OF PRINCIPAL FACTORS

Land use planning should achieve a balance between environmental sustainability, local area amenity, community safety and security, and safe mobility.

3.1 Adding Value to New Developments

Designing a safer road and path network helps produce broad community benefits:

- greater mobility for everyone, especially for children and older people
- sense of community, through increased walking cycling, and better security through natural surveillance
- sustainable development, through reduced car use with a quieter, cleaner environment
- more attractive areas to live in
- safer environments provide social and economic benefits to the community.

3.2 Designing for People

There are proven ways to design safe local road and path networks which:

- encourage bike riding and walking as a viable means of transport, fun and health
- reduce the number of car trips
- reduce traffic conflicts and crashes
- allow convenient vehicle access, without speeding on local streets.

Research shows that ‘unprotected’ road users (those not travelling in road vehicles) like pedestrians, cyclist and people in wheelchairs have a very high likelihood of dying in a collision with a motor vehicle if the speed at impact is greater than 40 km/h. This is illustrated in the following figure.

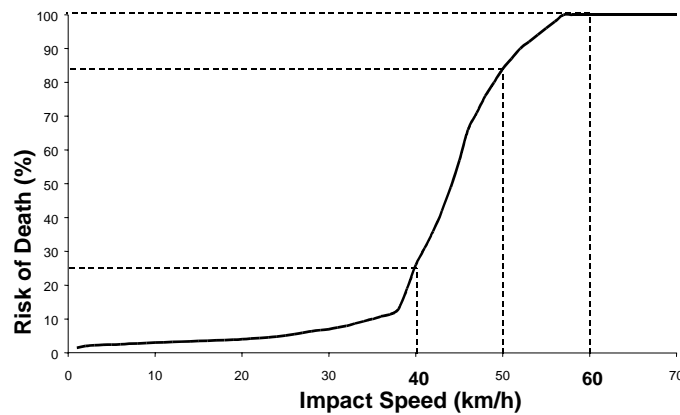


FIGURE 1: Risk of pedestrian death as a function of vehicle impact speed.

Source: Anderson, R., McLean, A., Farmer, M., Lee, B., & Brooks, C., (1997). Vehicle travel speeds and the incidence of fatal pedestrian crashes. *Accident Analysis and Prevention* 29(5), 667 – 674.

A Safe System should be designed for all road users and therefore must give consideration to this kind of information to ensure that it is safe for unprotected road users.

3.3 Design Goals

Design goals and standards for roads and pathways should reflect their roles and ensure that crash risk is minimized in each case.

3.3.1 Less vehicle travel

The number of road crashes tends to increase in proportion to the number of vehicle kilometres driven. Therefore creating an environment where car trips are fewer and shorter will reduce the number of crashes. This can be achieved by:

- providing employment, education and recreational opportunities within the new development
- clustering land uses into activity nodes (including schools and shops), to maximize public transport/walk/cycle options
- integrating planning, from the start of the planning process, for all transport modes (not only cars, motorcycles and trucks but also public transport, cycling and walking)
- planning for direct and convenient bus routes within walking distance of all new residential allotments
- introducing public transport services early in new growth areas.

3.3.2 Lower vehicle speeds

Research shows that as speed increases, both road crash likelihood and severity increase. This applies to all road users, but unprotected road users are particularly vulnerable to speed. As shown in Figure 1, unprotected road users have a very high likelihood of dying in a collision with a motor vehicle if the speed at impact is greater than 40 km/h.

Therefore in areas where there is a high level of activity involving unprotected road users, like strip shopping centres or in the local street network, consideration should be given to lowering vehicle speeds. Lower speeds also make it easier to cross the road, particularly for older pedestrians or people with disabilities.

Speed is also an important issue at intersections. The accepted upper limit of survivability for side impacted vehicle occupants is 50 km/h. Therefore intersections should be designed to avoid cross roads and to limit the speeds of an impacting vehicle in a side impact crash below 50 km/h.

Lower vehicle speeds can be achieved by:

- limiting straight lengths of streets (over say 200m)
- providing roundabouts or off-set t-junctions
- narrowing street pavements
- using linemarking to reduce the effective road width e.g. with on-road bicycle lanes
- using alternative contrasting road surface treatments at the entry to a street
- using speed control treatments ('traffic calming').

3.3.3 Physical separation

The safety of different road users can be enhanced by physically separating them and reducing areas of potential conflict. By separating high speed traffic from low speed road users, safety is enhanced in two ways. Firstly, there is less likelihood of conflict and secondly, as walking and cycling becomes safer more people are inclined to do so and leave their vehicles behind thereby reducing the amount of vehicle travel.

This objective can be achieved by careful planning for the arterial road network, local street network and the network of pedestrian and cycle paths.

- Arterial Road Network:
 - provide adequate capacity with arterials at around 1.6 km spacing
 - ensure it is well connected to adjoining arterial roads and the major activity centres
 - provide adequate lane widths for intended speeds and vehicle types
 - manage vehicular access to adjacent properties to minimize potential conflicts
 - no on-road parking on through carriageways
 - provide roadside clear zones for errant vehicles
 - provide good crossing opportunities for pedestrians.
- Local Street Network:
 - restrict traffic speeds
 - reduce vehicle to vehicle conflicts at intersections
 - reduce conflicts between vehicles and unprotected road users
 - minimize the need for trucks to enter the local street network and avoid causing them to reverse
 - create a well-connected (permeable) street pattern which is easy to navigate
 - do not obstruct sightlines at intersections with trees or signs.

- Pedestrian and Bicycle Path Network:
 - develop a strategic pedestrian and bicycle path plan
 - ensure it is integrated and continuous (on and off road for bicycles)
 - provide direct access to activity centres like schools, shops and sports areas
 - ensure network is adequate for abilities, especially for children, older people and people with disabilities
 - ensure as far as possible paths are separated from areas used by motor vehicles
 - provide pedestrian crossing facilities, with simple measures such as small median refuges or painted medians
 - provide grade separation or signal control at arterial crossings (make early planning decisions to exploit the natural rise and fall of the land)
 - provide paths on at least one side of all streets
 - ensure there will be good natural surveillance e.g. no high fences
 - include routes along arterial network
 - provide good signing
 - fence paths off from busy or narrow points e.g. outside schools, at intersections, near pedestrian crossings or on bridges
 - fence off children's play areas from roads.

3.3.4 Safer Roadsides

Each year in Victoria there are over 4,000 run-off-road casualty crashes. Nearly three-quarters of these involve a collision with a roadside hazard like a pole, tree or fence. More effective land use planning could play an important role in reducing these crashes by giving careful consideration to where poles, trees, fences and other road hazards are initially placed. Aims need to include:

- to provide a clear roadside zone where errant drivers can recover the control of their vehicles. (road design guides specify clear zone widths)
- to provide impact-absorbing barriers if roadside hazards have to be placed within the clear zone
- to manage roadside landscaping and vegetation so as not to present a hazard to motorists (e.g. restricting tree trunk sizes less than 100mm)
- to install undergrounding power services, not only to eliminate dangerous street poles but also to improve the appearance of the neighbourhood
- to manage hazards on the side paths, particularly those used by cyclists who can reach near to motor vehicle speeds.

3.4 The Planning Process

3.4.1 Regional Planning

There are many opportunities to improve road safety right at the beginning of the planning process at the Regional level by having appropriate strategies in place:

Public Transport Strategy

Safe strategies include:

- minimize crash exposure by maximizing public transport usage
- activity centres located near railway stations or other public transport interchanges so that public transport is convenient
- safe and convenient access to transport interchanges by people of all abilities and ages and by all modes of transport, particularly walking and cycling
- schedule public transport infrastructure development (stations and public transport interchanges) to suit residential development needs
- encourage bus operators to extend routes into new residential estates at the earliest possible stage so that reliance on cars can be minimized.

Arterial Road Strategy

Safe strategies include:

- ensure that an adequate arterial road network is provided (around 1.6km spacing) including freeways for longer trips and freight movement
- ensure separation between through-traffic and unprotected road users
- provide safe crossing opportunities for pedestrians and cyclists
- ensure that access management and clearway strategies are in place
- develop an effective strategy for dealing with railway crossings
- reduce speed through intersections (target 50 km/h side impact speed maximum)
- provide a safe roadside for errant vehicles.

Cycling Strategy

Safe strategies include:

- develop a strategic plan for cycling
- provide safe on-road and off-road facilities.

3.4.2 Development or Local Structure Plans

At the next level of land use planning, road safety can be enhanced by giving careful consideration to the arterial and collector roads, commercial or activity centres, the location of schools and pedestrian and cycling paths.

Arterial Network

Safe strategies include:

- ensuring the arterial road network has the capacity to accommodate future growth in regional traffic, particularly trucks

- vehicular access to and from adjacent land to be managed to protect the safety of all road users
- intersections to be carefully planned to provide safe access for all road users (such as roundabouts wherever possible with signal metering at higher volume sites to extend their application and effective operational life)
- provision for safe pedestrian crossing
- consider grade separation for any new railway crossings
- locating activity centres near railway stations or other public transport interchanges so that public transport convenience is enhanced.

Commercial/Activity Centres

Safe strategies include:

- activity centres should be planned to be free of vehicular traffic if possible, otherwise speeds should be engineered to be as low as possible
- main bus routes should provide direct connections with major activity centres
- pedestrian and cycle paths should provide direct, continuous access.

Schools

School locations should be carefully planned to provide safe and convenient access for pedestrians, cyclists, public transport and motorists.

Pedestrian and Bicycle Paths

Safe strategies include:

- as far as possible pedestrian and cycle paths should be separated from major traffic routes, whilst maintaining personal security (i.e. being open and visible)
- paths should be continuous, convenient and connect with adjacent networks
- paths should have a consistent standard and be well signed.

3.4.3 Subdivision Plan

Arterial Network

Safe strategies include:

- the arterial road network should provide enough capacity and directness so that through-traffic will not use local and collector roads
- safe cycling should be provided, preferably off-road
- if possible, speed on the approaches and through intersections should be reduced (this is one of the major reasons why roundabouts have such a good safety record)
- intersections should provide safe and convenient access for pedestrians and cyclists e.g. controlled crossing facilities at roundabouts
- intersection layouts should provide safe sight-lines across corners

- vehicular access to and from adjacent land should be managed to protect the safety of all road users
- public transport stops should be located carefully to ensure the safety of users.

Local roads

Safe strategies include:

- speed should be managed very carefully on local roads through limiting straight lengths (to about 200m) and with speed control measures
- residents and visitors should be able to navigate through an area safely and easily (no more than three turns to reach a collector road)
- intersections should be designed to prevent corner cutting
- intersections should indicate clear right-of-way priority and provide safe sight-lines across corners
- intersections should provide safe and convenient access for pedestrians
- access in and out of residential drive ways should be safe and convenient
- safe cycling facilities should be provided
- provision should be made for emergency access and for occasional truck movements.

Schools

Safe strategies include:

- school locations should be carefully planned to enable safe access by foot, bicycle, public transport or car
- speed should be carefully managed around schools, preferably through self-enforcing physical constraints
- all access paths and pedestrian and school crossing facilities should be planned in an integrated manner
- adequate provision should be made for on-site parking so that staff cars do not cause congestion and block visibility along and across frontage streets
- the management of traffic during drop-off and pick-up times should be carefully considered taking into account the safety of all road users
- navigation from school sites to the arterial road network should be simple and convenient and should limit unnecessary circulation of traffic through local streets.

Pedestrian and Bicycle Paths

Safe strategies include:

- all local streets should have footpaths on at least one side so that pedestrians don't have to walk on the road
- paths should be continuous, convenient for people of all abilities and connect with activity centres and adjacent networks
- paths should have a consistent standard and be well signed

- as far as possible pedestrian and cycle paths should be separated from major traffic routes, whilst maintaining personal security (i.e. being open and visible)
- at locations where paths cross busy roads, facilities should be provided to ensure safe and convenient crossing (e.g. slow points, median refuges, traffic signals).

3.4.4 Arterial Transport Corridor Plan

Whenever it is planned to further develop an existing arterial transport corridor, there will be opportunities to improve road safety. The crash history of the corridor should be analysed and a road safety audit carried out so that existing problems can be addressed. Safety issues can be considered along the corridor, at intersections and in terms of unprotected road users.

Along the Corridor

Safe strategies include:

- kerbside parking should be managed so that arterial road safety and efficiency are not compromised
- side-road and frontage property access should not compromise arterial road safety and efficiency
- public transport stops should be located to maximize safety of users
- it should be ensured that the road geometry is adequate for all types of large trucks
- an appropriate clear zone should be provided or hazards modified or shielded
- consideration should be given to facilities for high-occupancy vehicles.

At Intersections

Safe strategies include:

- intersections should be controlled in an appropriate way to ensure the safe and efficient movement of all road users
- clear sight lines should be provided across corners and across roundabouts and for pedestrian movements.

Unprotected Road Users

Safe and convenient pedestrian/cycle paths should be provided along and across the corridor, suitably separated and controlled.

3.4.5 Commercial/Infill Development Proposals

When individual commercial or infill developments are being planned consideration should be given to safe site access from arterial roads, parking/loading areas and unprotected road users. The existing crash history in the vicinity of the proposal should be analysed and a road safety audit carried out to address current safety problems.

Arterial Road Access

Safe strategies include:

- intersections and access points on arterial roads should be suitably located and controlled and designed to safely accommodate future traffic volumes
- provision should be made for safe truck access
- clear sight-lines should be provided across intersections and through roundabouts.

Parking and Loading Areas

Safe strategies include:

- sufficient off-street parking should be provided to prevent overspill parking and traffic on adjacent roads
- the layout off-street parking should ensure safe access and manoeuvring of cars
- the layout of circulating roads and loading docks should ensure separation of vehicle movements from pedestrians
- pedestrian and cyclist movements should be separated as far as possible from vehicular movements
- safe and convenient access should be provided for trucks and buses.

Unprotected Road Users

Safe strategies include:

- safe and direct paths should be provided for unprotected road users
- consideration should be given to providing priority to unprotected road users in appropriate areas
- Disability Discrimination Act (DDA) requirements should be included
- lighting should be provided where appropriate.

4. Political, social and other factors

Land use planning involves a very broad range of people:

- the developers – town planners, urban designers and traffic engineers
- local government – councillors, planners and traffic engineers
- state government – infrastructure planning, land use planning and education
- the community – consumers, workers, local residents etc.

Because of the broad effect of land use planning activities, it is important that there is always appropriate community consultation involved and adequate information is provided to the community. Certain safety measures like speed reductions or restrictions to vehicular or pedestrian movements, can easily generate opposition if the reasons for them are not soundly based and properly explained.

With some of the larger land use developments, there can be a multiplicity of issues and interests. It is therefore important to raise road safety issues as early as possible in the planning cycle.

5. CONCLUSIONS

There are many opportunities to reduce the road toll through more careful and considered land use planning at all stages of the planning process. Road safety can often be enhanced at the planning stage at little extra cost. Conversely bad planning can set poor safety 'in concrete' and can be very costly to correct later.

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