DESIGN STANDARDS
for
URBAN INFRASTRUCTURE
2 ROAD PLANNING

URBAN SERVICES

2 ROAD PLANNING

2.1 General

There are two principle areas of road planning, viz, residential and arterial, the latter being the major distribution system to the local street network. This Chapter primarily provides guidelines for road planning in residential neighbourhoods, whilst the reference documents and Planning and Land Management (PALM) should be consulted for planning of the rural and urban arterial road systems.

A fundamental requirement of the planning process is for designers and planners to determine networks that respond to the following inputs:

- Environment.
- Environmental sustainability
- Demography and demographic trends.
- Neighbourhood identity.
- Integration of movement modes.
- Recreational / community needs.
- Strategic residential planning.
- Public transport issues.
- Pedestrian and cyclist requirements, including access for disabled persons.
- Whole of life costs.

The road transport network should:

- Reflect a broad based (eg. metropolitan / district level) land use / transportation strategy.
- Translate that strategy into a series of movement routes and elements that perform desired functions, such as those listed above.

The spectrum of movement elements range from high level roads (high volumes, high speeds, no travel constraints) to low level streets and places (low volumes, low speeds, shared spaces, human scale and interconnectivity).

It is not the intent of this document to provide design and planning advice for town planning other than that which is necessary for practitioners to understand the role of road networks in the overall transport system. In this context the Integrated Land Use and Transport Planning in the ACT discussion paper (PALM, 1999) outlines directions for accessibility. A key Guiding Principle of Accessibility is that movement around the city by walking, cycling, public transport and driving should be easy and accessible. Priority should be given to the needs of transport modes in the following order of precedence:

- Walking
- Cycling
- Public Transport
- Commercial Vehicles
- Private cars

Refer to Chapter 13 Pedestrian and Cycle Facilities, for planning of pedestrian and cyclist networks.

2.2 Related codes of practice and guidelines

2.2.1 Legislation

Road Transport (Safety and Traffic Management) Act 1999

Road Transport (General) Act 1999

Territory Plan

Disability Discrimination Act.

2.2.2 Industry standards

Guide to Traffic Engineering Practice, Part 1: Traffic Flow, AUSTROADS.

Guide to Traffic Engineering Practice, Part 2: Roadway Capacity, AUSTROADS.

Guide to Traffic Engineering Practice, Part 3: Roadway Capacity, AUSTROADS.

Guide to Traffic Engineering Practice, Part 4: Roadway Capacity, AUSTROADS.

Guide to Traffic Engineering Practice, Part 5: Intersections of Grade, AUSTROADS.

Guide to Traffic Engineering Practice, Part 6: Roundabouts, AUSTROADS.

Guide to Traffic Engineering Practice, Part 7: Traffic Signals, AUSTROADS.

Guide to Traffic Engineering Practice, Part 8: Traffic Control Devices, AUSTROADS.

Guide to Traffic Engineering Practice, Part 9: Arterial Road Traffic Management, AUSTROADS.

Guide to Traffic Engineering Practice, Part 10: Local Area Traffic Management, Standards Australia.

AS 1348.1 Road and Traffic Engineering: Glossary of terms, Road Design and Construction, Standards Australia.

AS 3845: Road Safety Barrier Systems, Standards Australia.

Guide to Traffic Generating Developments, RTA NSW.

Guide to Geometric Design of Major Urban Roads, AUSTROADS.

2.2.3 Policy and guidelines

ACTCode for Residential Development.

ACT Parks and Vehicular Access Guidelines, PALM

ACT Crime Prevention and Urban Design Resource Manual, PALM.

Australian Road Rules, National Road Transport Commission.

(Draft) Noise Management Guidelines, PALM.

Noise Barriers and Catalogue of Selection Possibilities, NSW RTA.

Cycling Australia: The National Strategy, AUSTROADS

Canberra Bicycle 2000 Strategy, PALM

2.3 Performance statement

The performance requirements for road and street networks in residential areas are stated in ACTCode.

The primary objective is to provide street networks in which the function of each street is clearly identified and which provide acceptable levels of access, safety, amenity and convenience for all users. This is achieved by addressing the following:

- Provide convenient and safe access to leases for vehicles, cyclists, pedestrians and disabled persons.
- Provide appropriate access for buses, and emergency and service vehicles.
- Provide for a quality product that minimises whole of life costs.
- Provide an appropriate space for public utilities.
- Provide an opportunity for street landscaping.
- Provide convenient parking for visitors.
- Have appropriate regard for climate, geology, topography and the environment.
- Consider the impact on air quality in residential areas.

Major roads and intersections are the core elements of the overall road transport system. They provide links between the various land uses and communities. Their function is to provide a safe, reliable, efficient, convenient transport route for all types of vehicles and cyclists. Whilst the development of major roads will normally have significant impacts on the environment and local topography, road planning should address such issues as:

- Noise levels at adjacent communities.
- Impact on areas which have sensitive heritage, cultural and archaeological status.
- Impact on flora and fauna.
- Requirements to accommodate crossings for off road pedestrian and cycling routes in a way that minimises pedestrian / cyclist and vehicle conflicts.
- Minimise operational costs and costs to manage the road system.
- Air quality issues.

2.4 Road planning standards

2.4.1 Strategic road planning

In general, Planning and Land Management (PALM) is responsible for strategic network planning for roads in the ACT. ACT Roads and Stormwater may initiate modifications to existing road networks where deficiencies are identified.

The requirements for strategic planning for the road system will usually be contained in plans and documents such as:

- National Capital Plan
- Territory Plan (through the Land (Planning and Environment) Act).
- Outline Plans / Section Plans.

- Deeds of Agreement.
- Implementation Plans.
- Development Applications.

Proposals for new arterial roads or those in which adjacent land uses are effected may be subject to a formal variation of the Territory Plan.

Designers should ensure that the road network complies with the strategic planning requirements contained in the above documents and the principle reference documents, AUSTROADS and ACTCode.

2.4.2 Road classification

For the purposes of this document the term streets and roads are interchangeable, however in planning terms there is a distinction. Roads primarily have no access or restricted access provisions whilst streets allow frontage and vehicle access.

As part of the hierarchical road network, roads in the ACT are classified according to functionality using the NAASRA classification system:

Rural Areas

Class 1

Those roads which form the principal avenue for communications between major regions of Australia, including direct connections between capital cities.

Class 2

Those roads, not being Class 1, whose main function is to form the principal avenue of communication for movements:

- Between capital city and adjoining states and their capital cities; or
- Between a capital city and key towns; or
- Between key towns.

Class 3

Those roads, not being Class 1 or 2, whose main function is to form an avenue of communication for movements:

- Between important centres and the Class 1 and Class 2 roads and/or key towns; or
- Between important centres; or
- Of an arterial nature within a town in a rural area.

Class 4

Those roads, not being of Class 1, 2 or 3, whose main function is to provide access to abutting property (including property within a town in a rural area).

Class 5

Those roads which provide almost exclusively for one activity or function which cannot be assigned to Classes 1, 2, 3 or 4.

Urban Areas

Class 6

Those roads whose main function is to perform the principal avenue of communication for massive traffic movements.

Class 7

Those roads, not being Class 6, whose main function is to supplement the Class 6 roads in providing for traffic movements or which distribute traffic to local street systems.

Class 8

Those roads not being Class 6 or 7, whose main function is to provide access to abutting property.

Class 9

Those roads which provide almost exclusively for one activity or function and which cannot be assigned to Class 6, 7 or 8.

ACT Roads and Stormwater maintains a map of the ACT indicating the network of roads by classification.

2.4.3 Road hierarchy

A hierarchical road network is essential to maximise road safety, amenity and legibility and to provide for all road users. Each class of road in the network serves a distinct set of functions and is designed accordingly. The design should convey to motorists the predominant function of the road. Essentially there is a broad division between arterial and non arterial (or local) roads.

2.4.3.1 Arterial roads

Servicing the individual residential areas are the major roads that are Class 6 and in some cases Class 7 roads. These are important transport routes that provide for the major traffic streams in terms of both volume and speed.

In the ACT, there are three distinct types of major road:

- Sub-Arterial.
- Arterial.
- Parkway.

2.4.3.2 Non arterial roads

There are four distinct street types in residential areas:

- Access Places – Class 8.
- Access Streets – Class 8.
- Collector Street (Minor) – Class 7.
- Collector street (Major) – Class 7.

The lowest order of road (Access Place) having as its primary function, residential space / amenity features which facilitate pedestrian and cycling movements and where vehicular traffic is subservient in terms of speed and volume to those elements of space, amenity, pedestrians and cyclists.

The next level of road (Access Street) should provide a balance between the status of that street in terms of its access and residential amenity function. Residential amenity and safety are dominant but to a lesser degree than Access Places.

All collector Streets have a residential function but also carry higher volumes of traffic than the lower order streets. A reasonable level of residential amenity and safety is maintained by restricting traffic volumes and speeds, however amenity and safety do not have the same priority as Access Streets and Access Places.

Major Collector Streets provide the principal link between the residential street network and the arterial road system. These streets often require frontage access restrictions due to traffic volume and speed considerations.

Refer to ACTCode for full descriptions of these street types.

Other non arterial roads include Town Centre and industrial roads.

2.4.4 Road network

ACTCode provides guidance for specific design and planning requirements for roads in residential areas in the ACT. The acceptable solutions contained therein should be viewed as examples only. There are a range of solutions that meet the requirements to varying degrees. Designers are encouraged to develop road layouts that address the core Performance Criteria rather than merely adopting the minimum standard and solution. Innovation can lead to improvements in amenity, safety and other elements such as streetscape, legibility and on going maintenance costs.

The design features of each type of road convey to the driver its primary functions and encourage appropriate driver behaviour. This can be achieved by complying with the following requirements wherever possible:

- Traffic volumes and speeds on any road should be compatible with the residential functions of that road.
- The maximum length of an access street should ensure its status as a residential place is retained, where the traffic, in terms of speed and volume will enable the integration of pedestrian, bicycle and vehicular movements. This length will also ensure that residential convenience is not unduly impaired as a result of speed restraints.
- The length of collector street (major) within a development should be minimised.
- The time required for drivers to travel on all streets within the development should be minimised.
- Where access streets form part of a pedestrian or bicycle network, access links should provide suitable connectivity with adjoining access streets or open space systems so as to ensure such pedestrian and bicycle networks are functionally efficient.
- The road network should ensure that no road links with another road which is more than two levels higher or lower in the hierarchy. In exceptional circumstances roads may link with others that are more than two levels apart, however, no access street or local street should have access to an access-controlled arterial road.

- Connections between internal roads should be T-junctions or controlled by roundabouts.
- The road layout should conform to the requirements of the external road network and satisfy the transport provisions of an outline plan.
- The external road network should be designed and located to provide routes which are more convenient for potential through traffic within the network. Major roads should be provided at intervals of no more than 1.5km and should be complete and of adequate capacity to accommodate through network movements. The internal road system should not provide through routes that are more convenient than the external road network.
- It is preferred that the residential road network should be such that speed control is inherent in the layout design, ie. bends and some intersection types provide speed calming rather than devices such as raised platforms or chicanes.

2.4.5 Design speed

Refer to ACTCode for guidance on the requirements for design speed for the various road types in residential areas in the ACT.

Design speed is generally used as the basic parameter in the specification of other design standards. Therefore from a road planning perspective it is important that the road hierarchy and road layout are developed in an integrated manner to ensure the design speeds can be maintained without undue artificial treatments.

Adoption of a low design speed discourages speeding, however, where vertical or horizontal curves of low design speed are located in otherwise high speed sections the result is a potentially dangerous section of road. It should be recognised that in low standard roads, operating speeds will tend to be in excess of arbitrary speed standards. Attention should be given to ensuring that potentially hazardous features are visible to the driver and adopting traffic engineering measures which will help a driver.

Designers should be aware of the impact that terrain has on the function of the road network in terms of speed. Steep terrain requires special attention to road planning and design. Designers should take care to avoid designs in steep terrain that are developed using minimum design standards. In such cases the compound effect can lead to a less than desirable outcome.

The need for road safety barriers shall be assessed and designed in accordance with AS3845, Road Safety Barrier Systems.

Refer to Chapter 3 Road Design for further discussion on road design guidelines.

2.4.6 Road Reserve Characteristics

The cross section of the road reserve must provide for all functions that the road is expected to fulfill including safe and efficient movement for all users, provision for parked vehicles, acting as a buffer from traffic nuisance and noise, the provision of public utilities and streetscaping.

Chapter 4, Road Verges, provides guidance on how utilities, trees, paths, etc can be accommodated in road reserves to satisfy operational and maintenance objectives.

In addition to the above requirements, the road layout and selected reservation should comply with the following:

- Widening may be required to allow for wider vehicle paths (using AUSTROADS turning templates or acceptable computer software).
- The carriageway width must allow vehicles to proceed safely at the operating speed intended for that level of road in the network and with only minor delays in the peak period. This must take into consideration the restrictions caused by parked vehicles where it is intended or likely that this will occur on the carriageway. Vehicles include trucks, emergency vehicles and, on some roads, buses.
- The safety and convenience of pedestrians and cyclists where it is intended they use the carriageway must also be assured by providing sufficient width or off road paths.
- The carriageway width should also provide for unobstructed access to individual blocks where permitted in residential areas. Drivers should be able to comfortably enter or reverse from a block in a single movement, taking into consideration the possibility of a vehicle being parked on the carriageway opposite the driveway.
- Appropriate verge width should be provided to enable the safe location, construction and maintenance of required footpaths and public utility services (above or below ground) and to accommodate the desired level of streetscaping. Wherever possible services should be located in shared trenches.
- The verge, when considered in conjunction with the horizontal alignment and permitted fence and property frontage treatments, should provide appropriate sight distances, taking into account expected speeds and pedestrian and cyclist movements.
- Stopping sight distances and junction or intersection sight distances, provided by the verge, should be based on the design speeds for each road type in residential areas.

Refer to ACTCode for requirements for verges and overall reserve widths by street type in residential areas.

The road reserves for arterial, distributor and collector roads and roads in Town Centres and Industrial Areas should be designed for the predicted ultimate traffic volumes, accepted levels of service at intersections and accommodation of users including cyclists and commercial vehicles. Traffic analysis and pedestrian / cycling network master plans are required to identify planning requirements. In the case of Town Centres and Industrial Areas road planning should address provision of parking, bus facilities, waste collection, heavy vehicle access and appropriate facilities for pedestrians in Town Centres. Refer to Chapter 3 Road Design for detailed design parameters for major roads.

The planning of major roads in greenfields areas should consider fencing requirements such as:

- Ultimate residential fencing at the road boundary to suit noise attenuation and privacy requirements.
- Adjustments to rural fencing to accommodate interim land uses.

2.4.7 Provision for pedestrian and cyclists

Chapter 13 Pedestrian and Cycle Facilities, provides guidance on the requirements for both on road and off road cycling and for pedestrian facilities.

In the case of arterial roads where network planning for cyclists and pedestrians is not fully developed, the cross section and road reserve width should be determined by allowing provision for a Trunk Path on one side and a footpath on the other. The timing of implementation of the facilities will be dependent on funding, demand and final network planning.

2.4.8 Planning for restricted vehicle access

Depending on the urban environment and planning intentions, there may be a need, from traffic speed and operational considerations, to restrict vehicle access to leases from some roads. There are a number of solutions that can address this requirement:

- Lease conditions that require provision for turning around on the block to force forward exit. This could apply where traffic volumes are such that reversing movements would be unsafe or cause undue disruption to the traffic stream. This arrangement is generally permissible when there are adequate gaps in the traffic stream to allow vehicles to quickly exit from driveways. For roads with traffic volumes over 3000 vehicles per day, direct frontage access is not generally permitted.
- Prohibit vehicle access to the road and provide driveways at the rear via a lane or standard residential street. In the latter solution planners should avoid linear rear fences on the main road which present a poor urban streetscape. The rear lane option provides vehicle access at the “back” of the block whilst the block retains the front address on the main street. The streetscape in this case can be very good, particularly for medium / high density housing. For this option to work well, designers should consider the needs of visitor parking and how to develop a streetscape in the rear lane that is not merely wall to wall linear garages.
- Multi unit housing with single two way entry / exit road. Garaging is within the development and usually visitor parking is provided on block also.
- Provide a separate service road where residential access and on street parking are available. This option reduces the number of access points to the major road and provides a low volume and low speed environment for the house frontage. Such an arrangement could include driveway access or rear lane access if garages are not permitted on the service road (often also called a slip road).

2.4.9 Parking

The requirements for visitor parking in residential areas is covered in ACTCode.

Designers should consider provision of on street / off-street parking in conjunction with other issues such as driveway access, drainage, waste collection and streetscape. In developments with narrow frontages, parking provision on-street may be problematical and should be investigated on a case by case basis. There may be a need to prepare an economic evaluation of frontage dimensions and parking and access arrangements.

Refer to Chapter 9 Traffic Control Devices and Chapter 10 Parking Areas for further requirements. The ACT Parking and Vehicular Access Guidelines, PALM, setout the quantum of parking required for off street situations associated with development proposals.

2.4.10 Bus routes

ACTCode provides guidance on requirements for public transport within residential developments. Such provisions should include consideration of pedestrian access, driveway location and intersection sight distance.

Designers should liaise with ACTION and PALM on the provision of bus facilities including bus stops, shelters and priority measures in residential areas and the arterial road network.

Bus routes should have a minimum carriageway width of 7.5m and have other design requirements as indicated in Chapter 3 Road Design. Intersections and slow points on bus routes should be designed for adequate passage of buses.

Refer to Chapter 9 Traffic Control Devices for signage and linemarking requirements.

2.4.11 Intersections

The layout of intersections and roundabouts shall comply with the requirements of the reference documents, particularly AUSTROADS.

Whilst AUSTROADS Part 6 provides appropriate design guidance for major roundabouts, additional requirements are considered necessary for minor roundabouts in local residential streets, eg:

- Minor roundabouts with central islands and splitter islands that are trafficable by commercial vehicles are acceptable in low volume environments (Access Streets, Local Streets).
- In residential areas or low volume streets it may not be possible to meet all sight distance criteria in AUSTROADS. In such instances, Criterion 3 is a desirable objective to satisfy, but is not mandatory.

Refer to Chapter 3 Road Design for detailed requirements for design at intersections.

In the design of roundabouts and intersections Designers should consider options to minimise the number of sign posts. Signage at these locations is a costly maintenance task for asset owners.

The provision of vehicle access points to properties close to intersections and roundabouts needs to be carefully examined. Operational and safety considerations, particularly in high volumes roads, may warrant restrictions on access. Satisfying sight distance criteria may not be sufficient.

2.4.12 Signalised intersection or roundabout

At major intersections there are a significant number of factors that impact on the assessment of treatment solutions. Whether traffic signals or a roundabout are suitable is partly a planning task and partly an engineering design task. The following factors should be considered:

- Safety of motorists, cyclists and pedestrians

  When operating within their capacity limitations, roundabouts offer superior safety to traffic signals for motorists. Numerous studies indicate lower casualty accidents for roundabouts. The situation is less definitive for cyclists and pedestrians but it appears that if traffic volumes are moderate the splitter islands at roundabouts provide adequate crossing opportunities for cyclists and pedestrians. However, at higher traffic flows, particularly at dual lane roundabouts, the more positive control of signal operation may provide safer crossing opportunities, particularly for the very young and the aged. Partly for this reason there is a general preference to provide traffic signals in town centres.

  In high speed areas the safety advantage of roundabouts over traffic signals is increased.

Whilst the provision of multi lane roundabouts can be suitable for vehicles, it typically creates a hazard for cyclists on-road.

- Operating efficiency

  The volume and distribution of turning traffic are the prime considerations in determining relative operating efficiency between roundabouts and signals. Traffic signals are clearly favoured when through flows predominate, whereas roundabouts perform best when right turning flows are relatively heavy. A potential problem with roundabouts is the monopolisation of capacity which arises when one movement predominates.

- Operating and maintenance cost

  A signalised intersection is more costly to operate and maintain than a roundabout.

- Traffic flow characteristics required for satisfactory operation of downstream intersections.

  Uncontrolled downstream intersections (typically T junctions) may operate more satisfactorily if traffic signals are installed upstream. This is because the exit flow from roundabouts tends to be uniform and lacks the interruption caused by signals.

- Effect of possible traffic growth and / or traffic redistribution

  The capacity of the control type needs to be adequate for possible future growth and this may favour a particular control type. The introduction of a control may either attract or divert traffic to a particular intersection depending upon the relative congestion and delays associated with alternative routes.

- Public transport requirements

  The need to accommodate public transport routes may influence the choice of control type. Bus priority measures can be provided at signalised intersections.

- Requirement to accommodate long vehicles

  Long vehicles, because of their wide swept path when turning, may not be readily accommodated through small roundabouts.

- Speed of traffic

  Roundabouts, as well as controlling the speed of traffic, are inherently safer in high speed environments for the reasons mentioned previously.

- Construction costs

  Construction costs are normally site specific but in green fields situations traffic signals and roundabouts with similar capacity have been shown to favour roundabout construction primarily due to their adaptability for staging purposes.

- Land take

  High capacity roundabouts are generally more consumptive of land. However, small roundabouts can often be provided within the normal road reserve.

- Traffic management during construction

This aspect requires examination to determine if a design solution has any particular advantage in maintaining traffic flow through an existing intersection.

- Service alterations

  The location of underground and overhead services may inhibit the development of certain control types.

- Consistency with adjacent intersections

  In choosing a junction type, account must be taken of adjacent intersections for operational as well as aesthetic conditions. Traffic signals are readily linked to provide progression in the roundabout within a system of linked signals is inappropriate. Similarly, a traffic signal adjacent to a roundabout may cause operational problems due to queues from the signals banking up and disrupting flow on the roundabout.

- Environmental factors

  The operation of traffic signals causes stop-start traffic at all times of the day which may be environmentally intrusive whereas roundabouts permit un-interrupted flow during much of the day and night. However, any form of control may increase noise levels over the uncontrolled situation.

- Civic design considerations

  Traffic signals, while introducing obtrusive elements in the form of lanterns allow the continuity of through pavements to be maintained which may be of importance on ceremonial routes to maintain vistas and permit the passage of processions.

  Roundabouts, because of the requirement to install regulatory and warning signs and street lighting, do interrupt vistas along routes. The requirement to maintain sight distance across the roundabout limits the opportunity to ameliorate these aesthetic defects with landscaping except on larger roundabouts.

- Adjacent land use

  Adjacent land use may influence control type. For example, if a school or elderly citizen facilities are nearby, the speed reduction effected by a roundabout may indicate preference for this form of control.

2.4.13 Staged development of roads

Where the initial traffic volumes are expected to be moderate, staged construction may be warranted as an interim measure. Designers should consider options such as:

- Provision of a rural type road as a first stage if traffic volumes and levels of commercial vehicle traffic are low. Such a road could be built up to final levels and pavement depth at a later date, however traffic management may be a problem during reconstruction. Alternatively, the rural road could be the side track for the construction of the future roadway.
- A lesser standard first stage of a dual carriageway, eg. sealed pavement and no kerbs.
- Implementation of second stage earthworks or earthworks for sound mounds at a later time when actually needed (can depend on earthworks balance and landscape proposals).

A cost / benefit analysis is normally required to determine the most cost effective strategy and timing of staging of major roads. Refer to Chapter 3 Road Design for guidance on preparation of cost / benefit analyses.

2.4.14 Traffic data

The Department of Urban Services is responsible for maintaining records of traffic data in the ACT. The information includes the following:

- Traffic volume surveys.
- Vehicle speed surveys.
- Records of traffic accidents.
- Origin – destination surveys.
- Intersection accident diagrams.
- Ranking of intersections by accidents.
- Bicycle volume data.

In addition to the above, DUS holds information on road assets such as defects register and maintenance register. All traffic and road data is managed by Asset Information, ACT Roads and Stormwater.

A regular program of monitoring and data capture is in place. This includes updating the traffic data and filling in gaps in the data. Supplementary surveys may be required for specific projects to support studies or road planning strategies. Such special surveys should be costed in the project program provision.

Where existing traffic data is available, DUS will provide the information to designers as required for road planning and road design.

2.4.15 Transport modelling

2.4.15.1 Introduction

Occasionally, transport modelling will need to be undertaken to help quantify the impacts for various future urban planning situations, such as (but not limited to), those listed below:

- Considering options for new arterial or sub-arterial road connections.
- Testing new road layouts for large sub-division areas or town centres.
- Analysing strategic transport policy changes (ie mode split to public transport, etc).
- Considering the traffic impacts of large developments in a dense network situation eg new retail centre in Civic).
- Testing of options for traffic calming (LATM) to determine impacts and effectiveness of changes.

Transport models may be used for a variety of purposes. Most commonly, they are used to forecast future traffic flows, for economic analysis of major transport infrastructure projects and to estimate greenhouse gas emissions. There are a number of computer software packages available that offer the capability to undertake a wide range of analyses at the strategic level. Some include the capability to model networks at a finer level of detail than at the strategic level and some are designed with local area modelling as their primary focus.

Sometimes, use of a combination of models (ranging from "strategic" to "local area") may be necessary to predict future traffic volumes for a particular purpose.

2.4.15.2 Available transport models

For transport network modelling, there are a number of computer software packages that are suitable for forecasting future traffic flows on a network of connected street links. The ACT Government and some transport consultants in Canberra have used and developed network models for Canberra. The networks currently developed for the Canberra/Queanbeyan region have been used on the following software packages: TRIPS, TRANSTEP and TRANSCAD.

A number of other software packages, such as EMME/2 and Tranplan could also be used for these purposes. There are a range of other models which planners/designers may find useful for forecasting traffic volumes on networks, but care needs to be taken in the selection and calibration of such models.

In addition to the above, a number of dense network models for some of the town centres such as Civic, Tuggeranong and Belconnen have been developed based on the SATURN traffic model (which is especially suited to smaller networks with substantial detail modelled, such as each individual intersection). This model is suited to testing the impact of individual development proposals or land use policy changes on the road infrastructure at a fine level of detail. The SATURN model is often used in combination with one of the strategic models for more detailed analyses of future localised traffic flows. Other models with a "local area" or "sub-district" capability, including TRIPS, may provide suitable alternatives to SATURN.

2.4.15.3 Traffic modelling process

Transport modelling should be undertaken by appropriately trained and experienced personnel. The interpretation of model outputs should be undertaken by transport professionals experienced in the use of the particular software package and familiar with the program limitations.

Before traffic modelling is carried out, designers and practitioners should consult with the appropriate officers of PALM on:

- The currency of input data (for example, population, employment, retail space, school enrolments and other factors),
- Existing networks and any changes to them prior to the commencement of modelling, and
- Assumptions about future road links to be included in networks for future years.

The modelling needs to be appropriate for the level of assessment involved eg broad or more strategic modelling that examines the network impacts or fine grained modelling that considers the impact of intersections in some detail.

2.4.16 Traffic noise

During planning for new or upgraded roads, busways, etc, consideration should be given to possible intrusion of traffic noise into adjacent residential areas and areas where other noise-sensitive land uses are, or are likely to be, established. Predictions of future traffic noise levels should be determined using models acceptable to PALM and using performance criteria set out in the (draft) Noise Management Guidelines. TNOISE is one accepted model, generally used for site and/or local area analysis.

Noise forecasting modules associated with strategic transport models (such as TRANSTEP) or other local area models (such as SATURN) are not generally accepted for analysis of the noise impacts from traffic on individual road links or at specific sites. Their capability is limited to more general comparisons between/among towns and cities.

In circumstances where unusual site conditions exist, noise monitoring at the site, or at a proxy site in an existing area with similar traffic volumes and site characteristics, may need to be considered to assist in forecasting future traffic noise levels. Requirements for noise monitoring should be discussed with relevant PALM officers before such monitoring is undertaken. Measurement data for sites where noise monitoring has been undertaken by or for ACT government agencies is available from PALM's Structure Planning and Design Section.

Road planning and noise analysis should be undertaken in an integrated manner so that the selection of road reserve width allows the most economical form of noise barrier where required, to be considered. The investigation of the most appropriate means for achieving a reasonable level of noise in affected areas while minimising the cost of noise attenuation should form part of the planning process for a district, particularly in determining the width of road reservations for different classes of roads.

Factors considered might include additional land take for an increased reservation width, provision of mounds and barriers and urban design requirements. In some circumstances, special construction techniques for affected buildings may be appropriate. These matters should be normally be addressed during the planning process rather than during the design phase, although it may be necessary to refine approaches to noise attenuation during design.

For guidance on noise barriers, a useful reference is *Noise Barriers and Catalogue of Selection Possibilities*, published by the NSW Roads and Traffic Authority (August 1991). Further requirements are set out in Chapter 3 - Road Design.

2.5 Glossary

Acceptable Solutions: *Qualitative or quantitative measures that are considered to satisfy the relevant Performance Criteria, such that generally no further evidence of compliance is required.*

Access Street: *A street whose main function is to provide access to a small number of residential units.*

Amenity: *Features or facilities which provide an agreeable and comfortable quality of life.*

Arterial Road: *A road with a prime function to provide for major regional and inter-regional traffic movements.*

AUSTROADS: *The national association of road traffic authorities in Australia. Formerly NAASRA (National Associations of State Authorities).*

Carriageway: *Area of a road reserve provided for the movement or parking of vehicles.*

Collector Road: *A road with a prime function to distribute traffic between arterial rods and local streets.*

Design Speed: *A speed unlikely to be exceeded by most cyclists or drivers as appropriate, and not less than the 85th percentile speed. It is used to co-ordinate sight distance, radius, superelevation and friction demand for elements of the road or path so that* *cyclists or drivers negotiating each element will not be exposed to unexpected hazards.*

Driveway: *A roadway providing access from a road or street to abutting property.*

Footpath: *That portion of a road or street or other public place set aside for use by pedestrians only.*

Frontage Access: *Driveway access to a block at the front of the block, which is determined as the address to the street.*

Local Street: *A street with a prime function to provide access to adjacent land uses.*

Percentile Speed: *Speed at or below which the nominated percentage (eg. 15, 50, 85) of vehicles are observed to travel under free flow conditions.*

Performance Criteria: *General statements that provide a basis for judging whether a stated intent has been met.*

Rear Lane: *Type of road that is relatively narrow (less than 5m carriageway width with 1.5m verges) which provides vehicle access to the rear of blocks. The blocks address the street at the frontage.*

Residential Street: *A road, the main function of which is to provide access to residential properties.*

Roundabout: *A channelised intersection at which all vehicles move clockwise around a central traffic island.*

Service Road: *Type which is linked to and is generally parallel to a major road of low volume, low speed road and which provides vehicle access to a block.*

Slow Point: *An isolated treatment of a carriageway introduced as a traffic calming measure, eg. chicane, bend, raised platform, mini roundabout.*

Speed Environment: *Effectively the 85^{th} percentile speed for a particular road or path section.*

Stopping Sight Distance: *The sight distance required to enable a driver of a vehicle to perceive the need to stop, to react and actually stop the vehicle. It is the distance travelled by the time between when the vehicle actually stops moving.*

Utilities: *Those underground and overhead facilities that provide services to residential blocks and commercial developments. Normally includes gas, telecommunications and electricity, but can be expanded to include water, sewerage and stormwater drainage.*

Verge: *Public land within a Road Reserve between the road kerb and the property boundary.*