PART 4

Design

Design

4.1 Purpose

4.1.1 Purpose of Part 4

The purpose of this Part is to provide information on:

- the measures available to develop designs for environmental adaptation and how they might be combined to achieve specific objectives;
- general design parameters;
- the relationship between design and construction measures and the use of a package of measures;
- the process for achieving an integrated design;
- an illustration of a concept design process; and
- the steps in moving from concept to detailed design and completion.

4.1.2 Context

Design for environmental adaptation means the selection of design, construction and control measures and the manner in which they are combined to achieve specific objectives.

Part 3 provided information on setting the planning issues parameters before commencing a design. The focus in this Part is on design and control measures and how they can be used in combination to achieve the objectives and strategies referred to in Parts 1 and 2.

The information provided should be used as a guide. Each situation is unique and requires an individual approach.

- there are two stages in the design process for a Main Street project.

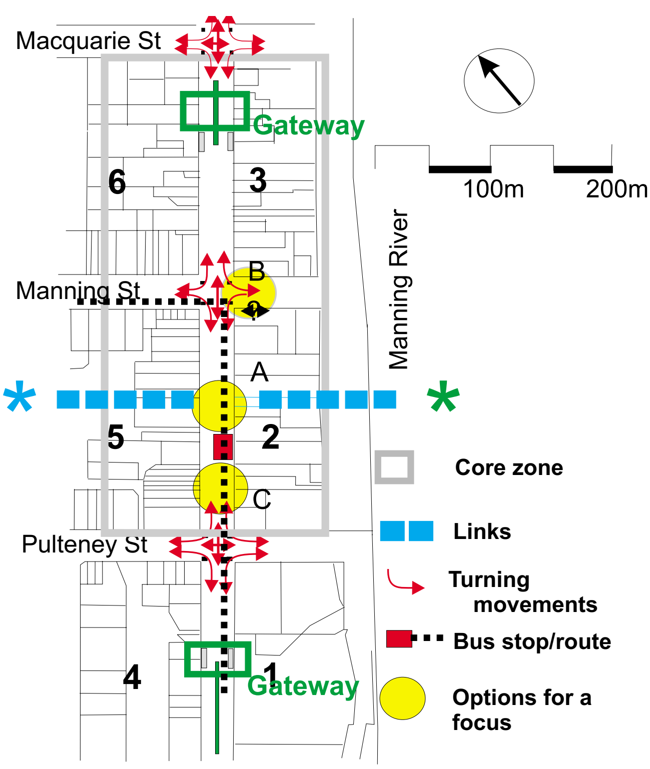


Fig. 4.1 From parameters for concept design

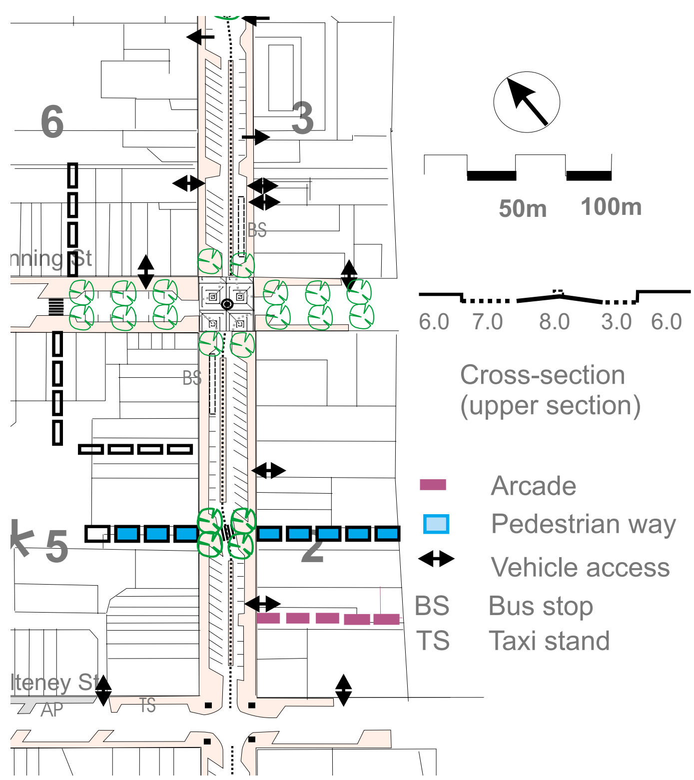


Fig 4.2 To concept design

1. the development of a concept design

This stage involves the exploration of alternative layouts and concludes with the selection of a concept or sketch plan. The emphasis in Part 4 is on the development of a concept.

2. detailed design

Detailed design starts with the concept and develops it to the point where tenders can be called for construction. There are three components: detailed urban design, engineering design and documentation, and the development of a financial plan.

4.2 Measures

4.2.1 Types of measures and their roles

A range of measures can be used for the design of integrated proposals for environmental adaptation. The measures in the Guide are divided into two major groups:

- C: Control measures; and
- D: Design and construction measures.

Each of these groups could be subdivided further according to whether a control measure relates to traffic or development control, or whether a design/ construction measure relates to the vehicle space, the pedestrian space, or to both.

The measures vary a great deal in nature, cost and time frame required for implementation. Although some measures are relatively inexpensive and simple - and these could be taken up by the majority of small local communities - some more expensive, and longer-term, measures have also been included to develop a comprehensive inventory. Taken together, they provide ideas for more extensive designs.

Appendix A contains 55 measures. A brief commentary is provided for each measure to highlight its specific aims, characteristics/applicability, limitations and expected impacts.

Many of the measures described in Appendix A, related to the control of traffic and design of traffic facilities, are documented in existing manuals and guidelines eg. AS 1742, 13 - 1991 Manual of Uniform Traffic Control Devices Part 13: Local Area Traffic Management, RTA Guidelines for Traffic Facilities and RTA Technical Directions.

It is beyond the scope of the Guide to include the detailed technical requirements, specified in these document. They should be consulted in developing detailed design (see References).

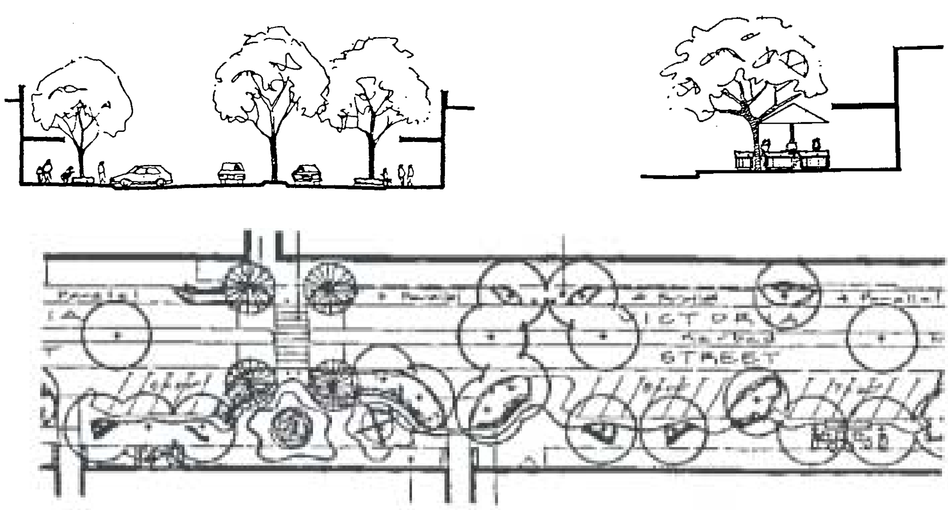


Fig. 4.3 To detailed urban design

4.2.2 Measures to achieve desired outcomes

The focus of the Guide is on:

- measures to support a speed profile;
- measures to support an activity profile; and
- measures to improve the quality of the road environment.

A range of measures exist to achieve a particular objective. Some are essential and these are called ‘primary’ measures. There are also measures which can be used to support the primary measures; these are listed as ‘supporting’ measures.

- Successful environmental adaption depends on a package of measures. Apart from a distinction between primary and supporting measures, there also are associations of measures which are compatible and others which are not compatible.

Some of these associations will be outlined in Section 4.4.

4.2.3 Measures to achieve a target speed profile

Fig 4-4 Measures to support a speed profile (Batemans Bay).

The principal objective is increase safety by reducing vehicle speed.

One single measure can seldom provide a solution for a reduction in vehicle speed. The effectiveness of a measure also varies. For example, speed zoning, through signs indicating the maximum permissible speed, require policing, but a well-designed roundabout and angle parking can be very effective in reducing vehicular speed without the need for policing.

The control of speed should ensure that there is a gradual and not a sudden change in speed. A speed profile should be established, requiring a combination of measures to achieve a gradual change (see Part 1, Figure 1.15).

Typically, it may commence with a gateway and/or a roundabout, followed by changes in the road cross-section, changes in parking layout and duration, pavement, vegetation and street lighting, type of pedestrian crossings and intersection treatments.

Table 4-1: Measures* to achieve a speed profile

Number	Measure	Number	Measure
	Primary measures		
C3	Speed zoning	D11	Two lane entry threshold
D12	Gateway	C9	Pedestrian crossings
D7	Roundabouts	C2	Cross pavement markings
C8	Traffic signals	D3	Variable carriageway pavement
D6	Staggered roadway	C4	Management of on-street parking
D22	Carriageway/lane narrowing		
D10	Raised pavement within intersection	C5	Management of on-street loading
D4	Raised pavement mid-section	D1	Off-line bays
D20	Shared/raised pedestrian crossing	D13	Tree planting in median strip
		D14	Tree planting in road shoulder
	Supporting measures		
D14	Shared space	C1	Channelisation
D16	Side street closure	D18	Street lighting
D7	T Junction rearrangement		
D8	Staggered junctions		

* refer to Appendix A

4.2.4 Measures to support an activity profile

The main objective of establishing an activity profile is to confine the area of pedestrian activity (Part 1, Figure 1.14).

This can be achieved by creating a core where pedestrian-generating activities are concentrated and a transition zone where vehicle-oriented activities are located. Activities which attract both pedestrians and vehicles, such as supermarkets, may be located between these dominant forms of activity. Alternatively, they can be located with a pedestrian frontage at the front and a vehicle orientation at the rear.

Although zoning and development control are important measures, there are others which can assist greatly in strengthening the core of a centre. These include footpath width, pavement and utilisation, continuity in weather protection and pedestrian movement (e.g. side street closures) and measures which assist the retail trade in the core.

Fig 4-5 Measures to support an activity profile (Crows Nest).

Table 4-2: Measures* to achieve an activity profile

Number	Measure		
	Primary measures		
C13	Activity-based zoning	C18	Off-street vehicular access/parking
C14	Frontage width control	C4	Management of on-street parking
C15	Floor space ratio control	D20	Shared/raised mid-block crossing
C16	Mixed use development	D18	Side street closure (to create pedestrian continuity)
C19	Infill/redevelopment	D29	Awning/verandah (to create climate protection)
D2	Footpath extension		
C20	Footpath utilisation		
C9	Pedestrian crossings		
C12	Bus stops		
	Supporting measures		
D17	Road closure - Main Street	D30	Tree planting in footpath
D16	Shared space	D13	Tree planting in median strip
D25	Narrow median	D14	Tree planting in road shoulder
D26	Wide median	D21	Street lighting
C22	Streetscape	C10	Bicycle way
C24	Heritage conservation	C11	Bicycle storage
C21	Advertisement control		

* refer to Appendix A

4.2.5 Measures to improve the quality of the road environment

Many of the measures available for creating a speed and activity profile can also be used to improve the quality of the road environment. For instance, side street closures may be used to create small urban spaces for recreation or social events.

Fig 4-6 Measures to improve the quality of the road environment (Campsie).

Table 4-3: Measures to improve the quality of the road environment

	Primary measures		
D12	Gateway	D14	Tree planting in road shoulder
C23	Views and vistas	D30	Tree planting in footpath
C22	Streetscape	D19	Creating a community focus
D2	Footpath extension	C24	Heritage conservation
D27	Footpath pavement design	D29	Awning/verandah
C20	Footpath utilisation	C21	Advertisement control
D13	Tree planting in median strip	D21	Street lighting
	Supporting measures		
D16	Shared space	C11	Bicycle storage
D3	Variable carriageway pavement	C12	Bus stops
D18	Side street closure	C18	Off-street vehicular access/parking
D22	Carriageway/lane narrowing		
D25	Narrow median	C6	Light traffic thoroughfare
D26	Wide median	C13	Activity-based zoning
C9	Pedestrian crossings	C16	Mixed use development
C4	Management of on-street Parking	C17	Infill/redevelopment

(Numbers refer to Appendix A)

4.3.1 Design parameters

Apart from determining the planning parameters (where appropriate, see Part 3), there is also a need to establish the design parameters before the design process can commence. There are both general and site-specific design parameters.

Four factors, taken together, have a significant influence on the application of design and construction measures. They are: peak hour traffic volumes; traffic composition; road reservation width; and temporal shifts in the priority of traffic and activity functions.

- The scope for environmental adaptation decreases with increased peak hour traffic volumes and narrower road reservations (Figure 4-7).

With peak hour traffic volumes in excess of 1000 vehicles per hour , the need to provide for a significant number of crossing pedestrians, and a road reservation of the order of 20 metres, there is often limited scope for measures involving a re-alignment of the carriageway. However, the objectives of environmental adaptation can still be achieved by using other measures for establishing a speed profile.

- The scope for narrowing the carriageway is influenced by the composition of the traffic stream, particularly the presence of large vehicles.

Road narrowing is an important tool in environmental adaptation. It reduces vehicle speeds and the distance pedestrians have to cross.

If the proportion of large vehicles is less than 5 per cent (or the number of large vehicles is less than 30 per hour), traffic volumes do not exceed 1000 vph and there is a separate route for cyclists, the carriageway can be reduced to 5.0 metres (both ways). However, if the proportion of large vehicle is greater but less than 10 per cent (or the number of large vehicles is less than 60 per hour) and the same other conditions apply, the width should not be less than 6.00 metres.

Other widths apply where there is a median separating opposing traffic streams and where there is angle parking along the kerb or in the median

- Bus routes and stops have major influence on design

Most Type II corridors are also trunk bus routes and the location of pedestrian crossings in relation to bus stops has an important influence on design.

- A significant factor is the form of provision for cyclists.

The Guide to Traffic Engineering Practice, Part 14, Bicycles (Austroads, 1993) recommends a width of 1.20 metres for a cyclist lane (in one direction) on roads where the traffic speed is 40 km/h in a shared arrangement or 1.5m marked cycle lane with a 2m marked vehicle parking lane.

However, the concept of Sharing the Main Street is based on sharing the carriageway under lower vehicle speed conditions (25km/h without a median and up to 35km/h with a median). There is no need for a separate bicycle lane, provided vehicle speeds are within this range, the number of cyclists is small and traffic volumes are moderate (Figure 4.8).

The situation could be different in transition zones where vehicle speeds may be 40 km/h. In that event, a separate cycleway may be justified if safety considerations and/or traffic volumes warrant it. Decisions should be based on a cycleway study for the area (see Part 3).

- Where there are shifts in traffic function during the day, priority measures need to be selected which do not impede peak hour traffic flow and also provide safe conditions for pedestrians at all times (Figure 4-9).

4.3 Design parameters

Fig. 4-7 Low volume roads with mostly local traffic offer greater opportunities for adaptation (The Entrance).

Fig. 4-8 In a low speed environment cyclists can share the carriageway, provided vehicle traffic volumes are not high .

Fig. 4-9 There are many sub-arterials which carry a high proportion of through traffic, limiting the range of measures that can be used.

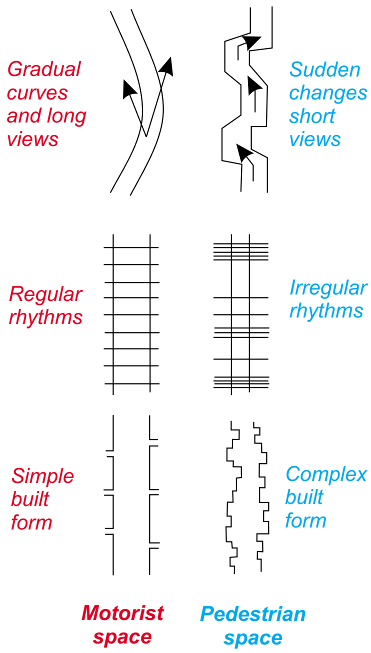


Fig. 4-10 Motorists and pedestrians perceive the road space differently. In a low speed environment, the two perceptions come closer together (after Rapoport, 1977).

There are many sub-arterial roads which carry a high proportion of through traffic in the peak hour, but mainly local traffic during off-peak periods. On-street parking controls, signal setting and turning bans, for example, can be used to change the level of friction at different times of the day.

The provision for parking and unparking manoeuvres and its effect on following traffic and jaywalking pedestrians deserves careful attention. There are significant differences in this relationship between vehicle peak and off-peak conditions and between pedestrian peak and off-peak conditions.

- Special attention should be given to overtaking vehicles and pedestrian movements in transition zones.

In the transition zone of rural towns, but preferably before the zone is entered, there may be a need to make provision for overtaking vehicles. Vehicles may have been prevented from overtaking slow moving vehicles on the open road.

Careful attention should be given to the need for pedestrians to cross safely if there are pedestrian generating activities such as schools. There is evidence to suggest that pedestrian/vehicle accident rates are greater in the transition zone than in the core. Further pedestrian-generating activities should be discouraged through development control.

- The design of the road space should recognise that pedestrians and motorists perceive the road environment differently (Figure 4-10).

In the approach zone, the motorist's perception should dominate. In the transition zone, there should be a marked contrast in the appearance of the road and its environment. This can be achieved, for example, by different cross-sections, building setbacks, parking and access arrangements and more frequent intersections.

In the core zone, more attention should be given to the pedestrian perception of the road space. The siting and design of buildings should be related to pedestrians, road pavements should reduced, a series of smaller spaces should be created, and close attention should be given to enclosure, climate protection, landscaping, lighting and street furniture.

- Landscape elements can make a significant contribution to the objectives of environmental adaptation, but must be used with care.

Canopies provide shade and can enhance the streetscape, but can also be used to affect driver behaviour). Although conditions are very different from those on the open road, safety should always be a major concern.

Small trees do not provide shade and reduce visibility. Trees located on footpaths should be free of overhead awnings. Aerial bundle conductors are a relatively low-cost option where overhead powerlines exist.

Trees located in road shoulders require robust guards to protect them from vehicles. Trees planted in the median must have adequate soil preparation, an area in which to grow and branches that do not conflict with passing traffic.

- Safe conditions should be created for all users.

Attention should be given not only to pedestrians, but also to cyclists in a shared road environment. For example, collisions between cyclists and doors of parallel-parked cars constitute a significant proportion of bicycle accidents and a minimum width of 3.5 metres is necessary for a bicycle/car parking lane (Austroads, 1993).

Design measures should also ensure safe conditions for drivers at night and during inclement weather. Measures which create friction during the day when there is much activity in the centre may not elicit the same driver behaviour at night when there are no pedestrians.

- The special needs of people with disabilities must be considered.

About 2 per cent of the population is visually impaired. To assist persons with such impairment, street furniture and displays should be positioned so that a continuous obstruction-free space is maintained.

The use of tactile tiles should be used to provide a physical `shoreline' to follow with directional tactile links to buildings and the kerb at pedestrian crossings and near vehicle access drives. Tactile tiles can also be used where facilities such as pedestal type phone booths can not be detected with a long cane. Tree branches should not be lower than 2 metres above the pavement.

There are other forms of impairment which require special measures (see Appendix A).

- Safe conditions should be created at any stage in the development of a project.

In many rural towns, but also in sub-arterial centres, the rate of change in frontage development is often slow. As a result, it will be difficult to achieve an activity profile quickly. The design should consider this disparity and ensure that a safe environment is created at all stages in the environmental adaptation process.

- Emergency vehicle access should always be factor in design.

4.3.2 Site-specific design factors

Site-specific design factors are determined after investigation and identification of local requirements. It is useful to list and present these requirements before commencing design. An example of the kind of design factors used in a specific situation is shown in Table 4-6.

In most situations, there will be engineering constraints (e.g. drainage, gradients) and requirements by service and utility authorities. Alterations to underground services are invisible, but can be costly and should be considered early in the development of the design.

4.3.3 Summary of design parameters

Table 4-4 shows an indicative list of design parameters for projects of environmental adaptation.

Table 4-4 Summary of design parameters

Situation	Design parameters
If peak hour flow is high	Measures not to impede peak flows
If there are heavy vehicles	Carriageway widths to take account of traffic composition or alternative route
If there are major shifts in traffic function during the day	Select measures appropriate for peak and off-peak conditions
If there are pedestrians in the transition zone	Special attention to crossing pedestrians
In all situations	Recognise special needs (cyclists, aged, people with disabilities)

4.4 Associations and applications

4.4.1 Where and when measures can be used

Table 4-5 shows the scope for applying different design and construction measures depending on peak hour flow, width of road reservation and shifts in priority. The table provides a summary of the circumstances where certain measures could be used (Y), where they should not be used (N), and where their application depends on the particular situation (D). The measures are grouped in three categories:

- vehicular space-related;
- pedestrian & vehicular space-related;
- pedestrian space-related.

Control measures (C) have not been included in Table 4-5 as they are generally not dependent on peak hour flows.

4.4.2 Associations

There are associations between measures, which need to be understood when developing a concept plan. For example:

- Bus stops are generally incompatible with angle parking;
- Taxi stands require a forward movement after picking up a passenger and are generally not appropriate in angle parking locations;
- Roundabouts are only compatible with pedestrians and cyclists where speeds and volumes are low;
- Rear angle parking adjoining footpaths with active pedestrian frontage are a potential health hazard;
- Where there is angle parking, a single lane and a median, extra space, a mountable median is required for emergency access in case of a breakdown or there should be occasional breaks in the median;
- Traffic signals create gaps for jay walking, roundabouts are less effective;
- There are design implications with right- hand turning bays at signal controlled intersections, which may affect jay walking and cyclists;
- There also are traffic management implications with signilisation which gives less priority to minimising delays to vehicles and greater priority to reducing the waiting time for pedestrians;
- In cases where there is a significant number of large vehicles, visibility may be impaired for pedestrians; visibility may also be reduced for drivers involved in parking and un-parking manoeuvres;
- Bus stops and pedestrian crossings;
- There are situations, where pedestrian crossings require signalisation; in other situations, signalisation is not necessary;
- Pedestrian type pavement should not be carried across the carriageway, unless pedestrians have priority and the appropriate "zebra" or "pedestrian crossing" markings are in place;
- There should be consistency in the use of different kinds of pavement, so that it is clear where the pavement is intended to be shared or allocated to a particular road user;
- Safety depends on unambiguity. Road markings are as important in low speed environments as they are in high speed environments and should be considered during detailed design; and
- The need for clarity (as well as safety) is also reflected in RTA Technical Direction 98/6 which relates to the design and marking of pedestrian crossings (see further Appendix A, D20).

Fig. 4.11 Rear angle parking is inappropriate in areas of high pedestrian activity.

Table 4-5 Guidelines for using design and construction measures

		Peak hour flow (total two ways)								
		>1000vph			1000-500vph			<500vph		
		Reservation width			Reservation width			Reservation width		
No	**Measure**	40m	30m	20m	40m	30m	20m	40m	30m	20m
	VEHICULAR SPACE-RELATED									
D1	Off-line bays	Y	Y	N	Y	Y	D	Y	Y	Y
D2	Footpath extension	Y	Y	N	Y	Y	D	Y	Y	Y
D3	Variable carriageway pavement	Y	Y	Y	Y	Y	Y	Y	Y	Y
D4	Raised pavement	D	D	D	D	D	D	Y	Y	Y
D5	By-pass roads	D	D	D	D	D	D	D	D	D
D6	Staggered roadway	Y	Y	N	Y	Y	Y	Y	Y	Y
D7	Roundabouts	D	D	D	D	D	D	Y	Y	Y
D8	T Junction re-arrangement	Y	Y	Y	Y	Y	Y	Y	Y	Y
D9	Staggered junctions	Y	Y	N	Y	Y	D	Y	Y	Y
D10	Raised pavement within intersection	N	N	N	D	D	D	Y	Y	Y
D11	Two-lane entry threshold	D	D	D	D	D	D	Y	Y	Y
D12	Gateway	Y	Y	Y	Y	Y	Y	Y	Y	Y
D13	Tree planting in median	Y	Y	N	Y	Y	D	Y	Y	Y
D14	Tree planting in shoulder	Y	D	D	Y	Y	D	Y	Y	D
D15	Visibility	Y	D	N	Y	Y	D	Y	Y	D
	PEDESTRIAN & VEHICULAR SPACE-RELATED									
D16	Shared space	N	N	N	D	D	D	Y	Y	Y
D17	Road closure (mall)	D	D	D	D	D	D	D	D	D
D18	Side street closure	Y	Y	Y	Y	Y	Y	Y	Y	Y
D19	Creating a community focus	Y	Y	D	Y	Y	Y	Y	Y	Y
D20	Shared/raised pedestrian crossing	D	D	D	Y	Y	Y	Y	Y	Y
D21	Street lighting	Y	Y	Y	Y	Y	Y	Y	Y	Y
D22	Carriageway/lane narrowing	D	D	D	Y	Y	Y	Y	Y	Y
D23	Railing of footpath/median	D	D	D	N	N	D	N	N	N
D24	Grade-separated pedestrian crossing	N	N	D	N	N	N	N	N	N
D25	Narrow median	Y	Y	Y	Y	Y	Y	Y	Y	Y
D26	Wide median	Y	D	N	Y	D	D	Y	Y	N
	PEDESTRIAN SPACE-RELATED									
D27	Footpath pavement design	Y	Y	N	Y	Y	D	Y	Y	Y
D28	Provision for the impaired	Y	Y	Y	Y	Y	Y	Y	Y	Y
D29	Awning/verandah	Y	Y	Y	Y	Y	Y	Y	Y	Y
D30	Tree planting in footpath	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y = Yes N = No D = Depends on specific situation – other factors apply: eg. target speed, pedestrian volumes, visibility and gradients

4.5 Concept design

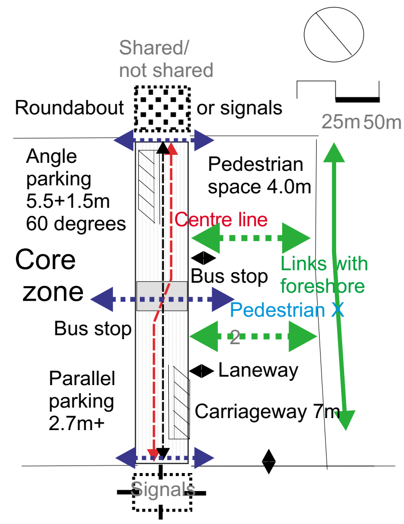


Fig.4.12 Example of parameters for concept design

4.5.1 Elements in concept design

There are a number of key elements - all of which are related to each other, and they can be integrated into a concept design in different ways. The elements are:

- the extent of the core and transition zones
- the speed and activity profiles appropriate for these zones
- portals (or 'entry gates')
- provision for turning movements
- intersection treatments
- the location of bus stops and taxi stands
- service access to sites and laneways
- parking
- lane width
- median and centre line
- pedestrian crossings
- pedestrian space
- treatment for cyclists
- sightlines
- overall character and landscaping.

The relevance of each of these key elements will be outlined in the following sections.

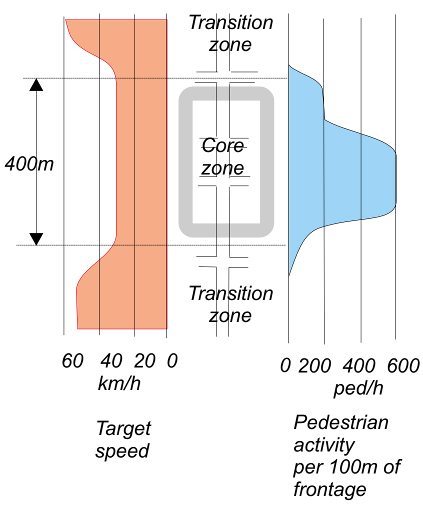


Fig 4.13 Determining speed and activity profiles

Core and transition zone

There generally is a clearly identifiable core of active pedestrian frontage. However, there often are dispersed retail outlets and the question then arises whether the core should be extended or whether further intensive retailing should be curtailed in such an area.

The core should be confined and the length of the active frontage is an important variable. The transition zone should not be extensive, but sufficient in length to prepare the driver for a different driver behaviour.

Speed and activity profiles

The speed profile fixes the target speed for the core and transition zones and provides for a gradual change in speed. The activity profile shows the intended concentration of pedestrian activity.

There could be a separate speed profile for each direction of flow and a separate activity profile for each side of the road.

A reasonable target in the core is 25 km/h for an undivided carriageway and 35 km/h when there is a median.

Fig. 4-14 Entry portal at Campsie

Portals (or 'entry gates')

Portals are intended to alert drivers to the need for changed driver behaviour. It is desirable to place them at the entry to the transition zones. There are different ways in which a portal can be designed (see Appendix A).

For example, a median with road narrowing can be introduced with a large tree in the median (or in the verges on each side). There are other options, such as a design feature, which create a distinctive image of the centre.

Turning movements

Careful thought should be given to the need to retain all existing turning movements as they have a significant influence on the design options available. Right-hand turns affect the design, because of the need to provide turning bays and safe pedestrian crossings.

There are trade-offs at intersections in providing for vehicle movement and crossing pedestrians. The turning movements of large vehicles (including buses) are especially important.

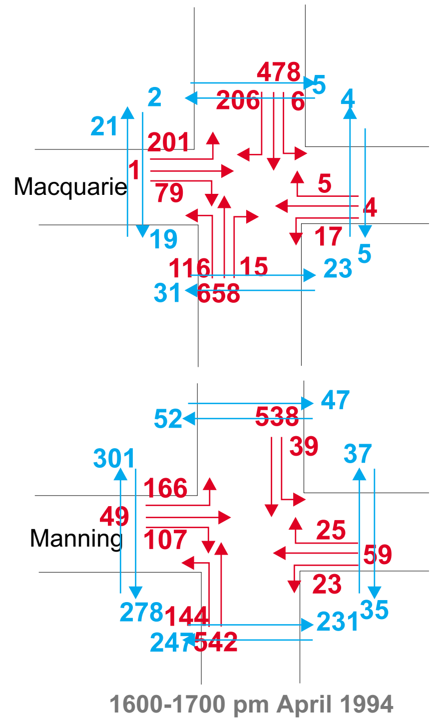


Fig 4.15 Intersection treatment requires consideration of pedestrian convenience and safety as well as the need for turning movements.

Intersection treatments

The principal criteria in the design of intersections are the need for safety and convenience. The design is often dominated by the needs of vehicles, but in the core of centres the needs of pedestrians should be considered first. There are different ways of combining the needs of pedestrians and vehicles.

Pedestrian priority crossings (e.g. 'zebra' crossings) are an effective way of giving priority to pedestrians, but only where vehicle speeds are low, there is adequate visibility (at night and day and on wet days), and turning movements are light. They are less satisfactory for vehicle traffic when right hand turning movements occur and there is a lack of clarity about priority.

Traffic signals can serve both pedestrian and vehicle movements. The timing of the cycles can be adapted to suit different conditions and priorities during the day. With heavy turning movements and large pedestrian flows, however, performance and/or convenience may suffer. Pedestrian convenience may be increased by a scramble phase during which no vehicles can enter and pedestrians can cross diagonally. A scramble phase may reduce the vehicle capacity of the intersection, but still allow it to function properly.

Roundabouts are an effective way of providing for safe and efficient vehicle movement through an intersection. They perform well when there are significant turning movements and no dominant traffic flows at particular points of entry.

However, roundabouts are not friendly for pedestrians and cyclists. Pedestrian crossings near roundabouts can be a problem for both pedestrians and drivers. They have to be located away from the roundabout for reasons of safety and operational efficiency (normally a distance of at least three vehicle lengths) and this makes them less convenient for pedestrians. Barriers then have to be put in place to prevent pedestrians crossing where the pedestrian desire lines are. At intersections where pedestrian movements are dominant and traffic volumes and speeds are low, crossings can be closer, but vehicle delays have to be expected.

Shared-use intersections are intersections where the Traffic Act of NSW for shared zones applies: "*When driving upon the shared zone one must lessen the speed of, or stop, that motor vehicle and allow to pass in front any pedestrian who is upon the shared zone and with whom that motor vehicle might collide*".

Shared zones carry a reduced speed limit of 10 km/h to allow pedestrians and motorists to interact safely. Signs are placed at the entry points to identify changed conditions for motorists, entry points such as raised thresholds may be incorporated and the design of the streetscape is often improved to make the area more pedestrian friendly. The vehicle traffic capacity is reduced, but convenience for pedestrians is increased and pedestrian safety is not impaired.

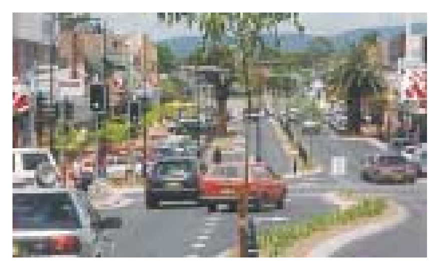


Fig 4.16 Provision for turning movement increases pedestrian crossing distance and requires space for waiting vehicles (Taree).

Fig. 4.17 Shared zone at Coogee.

Fig. 4.18 Bus stop (Campsie).

Bus stops and taxi ranks

Mid-block bus stops are convenient for pedestrians, but an impediment if it is proposed to provide angle parking adjacent to the bus stop. A mid-block bus stop should be 27 metres in length; a stop near an intersection should be 18m in length. The actual location of the bus stop depends on the function of the area. In the case of sub-arterial roads (Type II corridors), bus stops are of critical importance and a dominant factor in deign.

It may be possible to associate the bus stop with parallel parking on one side and provide angle parking on the opposite side. By staggering the bus stops on each side, the centreline can be varied and used as a speed reducing measure.

Taxi ranks should be located close to, or within, the core. The need for easy movement in and out of a taxi rank and quick access to a traffic route means that ranks should have parallel parking and be close to an intersection.

Fig. 4.19 Laneways and impact on treatment of the road space (Taree).

Service access and laneways

Rear access for servicing sites is ideal, but not always available. Laneways from the Main Street or sub-arterial road often provide service access. This constrains the options available for parking and widening of the footpath. Similar constraints arise from kerb-side loading and unloading.

Laneways combined with angle parking reduces the number of parking spaces by about 3 for each laneway.

Parking

The amount, duration, distribution and access will have been identified during investigation. The amount of parking and its proximity to active frontage are matters of crucial importance to the business community. It may be possible to increase the number of parking spaces in the Main Street or sub-arterial road by converting parallel parking to angle parking.

Fig 4.20 Information on parking availability should be clearly signposted (Campsie).

However, there is also an argument for giving priority to the improvement of pedestrian space and this may conflict with the need to increase on-street parking. Satisfying both objectives involves making trade-offs. Any loss in parking space should be compensated for nearby. Re-arranging employee and owner parking to maintain customer parking close to shops may also be needed.

Front angle parking is preferred in areas where there are many pedestrians on the footpath and there is significant vehicle traffic. In order to ensure safety and visibility, it is essential to provide a buffer space between angle-parked and moving vehicles of 1.5 metres.

Before preparing concept design options, it is useful to establish some basic dimensions for the elements of design. For example, for 60 degree angle parking (including the buffer strip), the distance from the kerb to the lane for movement should be 7 metres with parking bays of 3.7 metres width. For parallel parking, the dimensions are 2.7 metres (width) by 6 metres (length).

Lane width

Lane width is another important dimension. Generally, lane width for moving vehicles should be between 3.0 and 3.5 metres, but there may be circumstances where a greater width is required (see Section 4.3.1).

Median and centre line

A median assists in separating traffic streams, providing pedestrians with the opportunity to cross in two stages and improving the amenity of the Main Street. A wide median creates more space for landscaping and for turning bays. However, it takes up space which may be better utilised when the reservation width is limited. A wide median can then reduce the range of options.

A median can be used when there is only one lane in each direction, but care is needed to ensure access for emergency vehicles in case of a breakdown. One way is to create gaps in the median. Another is to construct a roll-over or mountable median in sections

There are different views on the minimum width of a median. In a low speed, low volume environment, the median can be as narrow as 0.6 metres. If trees are to be placed in the median, the width should be increased to at least 1.2 metres. Tress should be selected for their suitability (e.g. bracnhes, leaves and root systems).

The centre line can be straight or shifted along its axis varying along its length. It also can be in the centre or off-centre. Abrupt changes are undesirable, but barely perceptible changes have no effect on vehicle speed.

The balance between a clear zone and perceptual narrowings is a critical factor in safety and driver behaviour. Abrupt changes and poor sightlines should be avoided.

Fig 4.21 There are many options in the design of medians..

Pedestrian crossings

Pedestrian crossings should generally be provided at intersections and in mid-block locations, but if the street block length is greater than 300 metres, additional crossings may be required. The selection of mid-block crossings should be related to pedestrian desire lines and significant pedestrian-generating activities along the frontage or areas nearby.

Environmental adaptation is not limited to the provision of crossings along existing desire lines. There may be good reasons to locate crossings at points where future pedestrian-generating activities are to be encouraged or a social focus is to be created. There may also be scope for side street crossings and lateral expansion of the core.

Fig. 4.22 Side street pedestrian crossing (Campsie).

Pedestrian space

The minimum width for pedestrian movement without obstructions in areas of pedestrian is 2.5 metres, but when light poles, litter bins, seats and other obstructions are added, a minimum width of 3.0 metres is recommended. Pedestrian space greater than 3.0 metres can be used for street activity, such as cafes.

It may be desirable to increase the pedestrian space on one side only. This can create more effective space for community and other activities, and permits larger landscape elements, such as shade trees and fountains to be introduced. It is also possible to vary the width of the footpath along its length. However, there is a need for a continuous interrupted space for people with impairment.

The pedestrian space can be enlarged for special events, when parking areas and the carriageway can be closed for vehicles.

Fig.4.23 Footpath with space for outdoor activity (Blacktown).

Treatments for cycling

Fig. 4.24 Cyclist can share the carriageway, provided traffic volumes and speeds are low.

As indicated in Part 2, in the core zone, where vehicle speed as low, cyclists can share the carriageway. However, there are important design considerations. These are related to on-street parking, intersection treatments, vertical displacement measures, surface treatments and bicycle storage.

Angle parking, especially front angle parking , is a potential hazard for cyclists. Parallel parking should be clearly marked so that drivers park near the kerb and there is space for the opening of doors without intruding into cyclist space.

Two -lane roundabouts are a hazard and right hand turns at intersections require space for cyclists. Road narrowings for slowing down vehicles should not lead to a squeezing of cyclist space; special cycle space may be required at those points.

Road humps and other vertical displacement measures should be designed for safe cyclist use or be capable of being by-passed by special provisions for cyclists. Rough surface treatments may slow down drivers, but are a hazard for cyclists.

Bicycle storage facilities should be available throughout the core zone and in positions where they are in full public view.

Overall character and landscaping

Fig. 4.25 An overall design theme is used in many centres (eg. North Sydney) and makes them distinctive.

Adaptation, especially if it involves reconstruction, offers a rare opportunity to create a new environment in the heart of the community. Attempts should be made to identify the unique qualities of the Main Street and establish a distinctive overall character. An overall theme can help to shape to concept, but can also constrain it.

For example, there can be a conflict between the desire to create an avenue-type of boulevard and to also provide the maximum number of on-street parking spaces. Trees need to be regularly spaced where they do not interfere with awnings and verandahs and this may put them on an alignment where on-street parking spaces are proposed.

The RTA's Roadscape Guidelines may assist with the understanding of visual and landscape environments, and provides guidelines for how to manage visual and landscape elements on roads.

Sightlines

Sightlines should be considered carefully in several conditions:

- Visibility of pedestrians by drivers both during the day and at night; and
- Visibility of approaching vehicles, again during the day and at night.

Sight lines are determined by vehicle speed, intervening objects, illumination and ability to stop in the event of a conflict. In a low-speed environment, sight distances can be much lower than in higher speed environments (see for example, figure 1.9).

However, this is based on the assumption that the design elicits the desired driver behaviour and vehicle speed. This may not always be the case, especially at night when there are few pedestrians. For these reasons, there is a need for a safety audit (see Section 5.4.6).

4.5.2 Developing options

- Integrated options

Although all concept options should aim to satisfy the general objectives of environmental adaptation and the specific objectives established for the area, the central task is to develop a concept which integrates land use, road space and environmental design, and which is affordable.

- There are alternatives

There are different ways in which the elements can be combined. There will always be trade-offs and it is important for these to be explored (Figure 4-26).

For example, it is possible to create a pedestrian-friendly environment by increasing the amount of pedestrian space. It is also possible to develop a concept which maximises the availability of on-street parking. In most projects, there will be alternatives in the re-allocation of the road space and the views of the stakeholders should be sought.

- All options should include a package of measures

There are considerable risks if the concept focuses on a few measures, such as changing a parking layout, without other measures. The application of a few isolated measures may reduce safety, instead of enhancing it. Table 4-6 illustrates how a combination of design elements can produce different options.

- There will be options with different costs and staging potential

Environmental adaptation can involve significant expenditure of public funds and it is important to be aware of costly items.

There will be different price tags attached to each option and there will be differences in staging opportunities. These should be understood when options are evaluated.

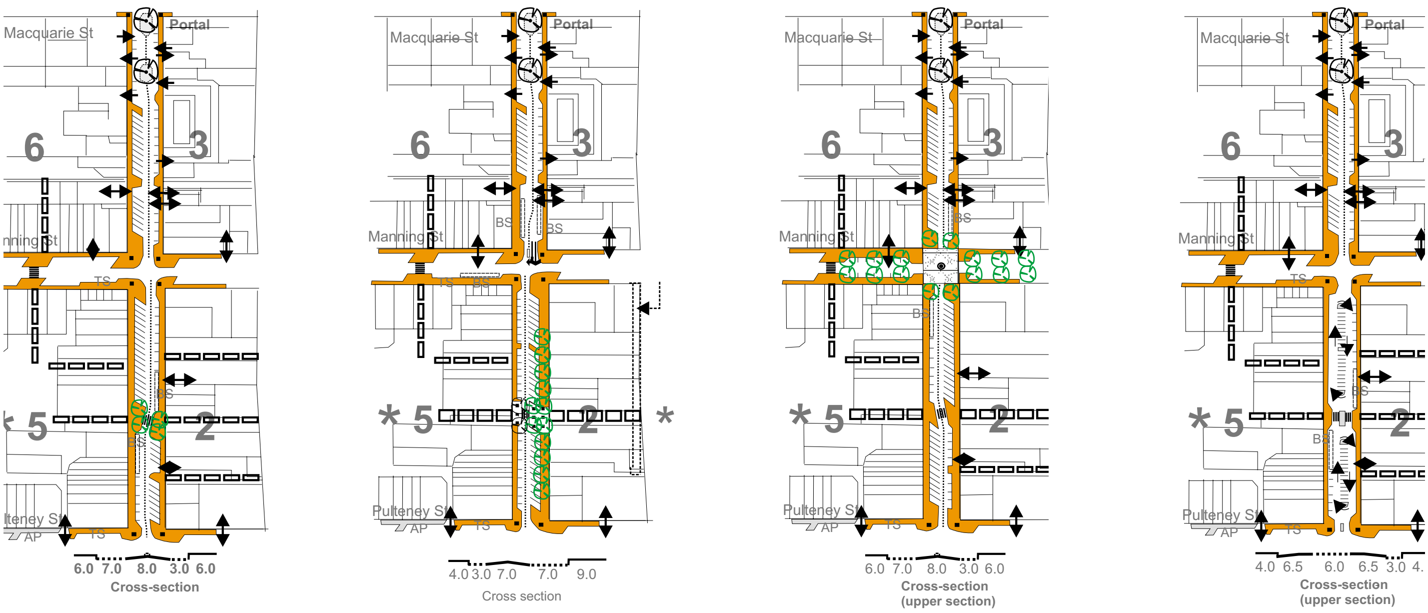
Different approaches can lead to significant differences in costs.

- Costs are greatly influenced by the reconstruction of pavements and

TABLE 4-6 Example of combining design elements and creating options

DESIGN ELEMENT	OPTION			
	A	B	C	D
Community focus:	mid-block	mid-block	Manning St	mid-block
Bus stop	mid-block	edge of core	near intersections	mid-block
Amount of pedestrian space	Increased	Increased	Increased	no major change
Location of pedestrian space	on both sides	on river side	variable	as is
Parking:	marginal increase	marginal increase	marginal increase	maximised
Centre line	axial shift	to the left	axial shift	centre parking
Intersection treatment	signals	signals	roundabout at Manning St	signals
Cross-links	arcades	major EW	major EW	arcades

(Based on Taree project)



Option A This is a least cost option. The focus is at the mid-block crossing. There is a narrow median and much of the existing pavement can be re-used.

Option B The pedestrian space has been increased on the river side and served by angle parking. The bus stop has been moved.

Option C The focus has been moved to create a stronger link with the river. There is a narrow median with an axial shift.

Option D Greater weight is given to increased parking which is located in the centre.

Fig 4.26 An example of design concept options (based on the Taree adaptation project)

sub-courses, modifications to stormwater drainage and relocation of underground services.

Table 4-7 provides information on actual costs (1998) incurred in the environmental adaptation of the Main Street of Taree. The project involved 400 metres of roadway (30 metres wide), three

Table 4-7: Example of actual costs of adaptation*

Category	Items	Expenditure	
Provision for traffic	Pavement marking	$95,076	4.87%
Intersection treatment	Traffic signals, roundabouts (not used here)	$122,950	6.30%
New traffic signs	Traffic and street signs, including replacement and warning signs	$11,239	0.58%
Drainage	Excavation and backfill, pipes and drains, drainage structures	$325,901	16.69%
Earthworks	Excavation, demolition and disposal	$103,190	5.28%
Alteration to services	Telstra, electricity, consumer mains	$68,546	3.51%
Pavement for vehicles	Pavement surface, sub-base and base course	$163,546	8.38%
Kerbs	Pedestrian areas, parking areas, medians	$112,102	5.74%
Driveways	Laybacks and dish crossings	$25,804	1.32%
Pavement for pedestrians	Medians and pedestrian areas	$377,748	19.35%
Landscaping	Trees (advanced stock) and shrubs, garden areas, tree grates and guards, planter boxes	$160,779	8.23%
Lighting	Includes bollards and banner poles	$330,424	16.92%
Street furniture	Seating, play equipment, litter bins	$32,466	1.66%
Miscellaneous		$22,823	1.17%
TOTAL		$1,952,594	100.00%

Source: Greater Taree City Council, 1998 intersections and reconstruction of the pavement.

In the example, the expenditure associated with this work accounted for one third of the total costs. Changes to intersections can also be costly, especially if major reconstruction is planned. Other major items are: pedestrian pavement (19%), street lighting and furniture (18%), landscaping (9%) and kerbing (6%).

4.6 Detailed design

4.6.1 Components

The concept design evolves through assessment, evaluation, revision and detailed design .There are three components of detailed design: urban design, engineering design and documentation, and the development of a financial plan.

4.6.2 Streetscape design

Streetscape design involves establishing the overall design theme, general image, geometry of space and streetscape design elements.

■ General image

Matters to consider include: the design of the portals, tree planting, upgrading of the building facade, retention of posted awnings, character of new buildings and parking areas.

■ Geometry of space

A major item is the design of the pedestrian space: routes and width, public seating areas, café space and permanent security

■ Design elements

The design elements include pavement of pedestrian areas, vehicle crossings, pedestrian crossings, setbacks, street furniture, awnings, lighting, banners and bollards and public art.

It is good practice to seek the participation of the stakeholders. They can relate to the design as it evolves and often make valuable comments which can be incorporated in the final design.

■ Master plan

It is useful to prepare a master plan if implementation is staged over an extended period. This has the advantage that the overall intentions are not lost when development resumes at a later stage

4.6.3 Engineering design and documentation

Engineering design focuses on drainage, services, pavement design and construction, traffic management, line-marking, safety, access and circulation arrangements during construction, and costs.

Interim parking arrangements also need to be addressed and publicised.

It is good practice to undertake a safety audit and consult with property owners who will be affected during construction.

4.6.4 Financial planning

It is essential to prepare a financial plan which indicates how the project can be funded and whether there is a need for staging. The plan should also identify whether any contributions will be sought from property owners or levies will be introduced to help pay for the scheme.

All these aspects of detailed design may lead to a need to revisit the concept design.

4.6.5 Legal responsibility

Another issue is that of legal responsibility in case of an accident. A duty of care always applies, and common sense is equally important. However, it is essential to avoid confusion, and this means careful use of measures, materials and signs. These principles are well established for the design of public parking areas, which also rely on a low speed environment.

The principle of shared use of the road space is already enshrined in the NSW Traffic Act. Shared zones carry a reduced speed limit of 10 km/h to allow pedestrians and motorists to interact safely. Signs are placed at the entry points to identify changed conditions for motorists.

A legal speed limit of 40 km/h is used in Main Street projects with a legal facility sign for each facility.

It should be noted that research and experience show that target speeds not exceeding 25 km/h are desirable in the core (or 35km/h if there is a median).

There is merit in creating a special type of zone for the core in Shared Main Street schemes with a signposted advisory speed limit of 25 km/h (or 35km/h) for the core zone as a whole, rather than a series of legal facility signs for each facility.

It should be stressed that this may be a possibility in future, but is not yet within the bounds of current procedures.

Fig. 4.27 Facility signposting (Crows Nest).