Chapter 5.2

5.2

Public transport

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INTRODUCTION

Public transport policy, strategy, planning, operations and management are all currently in a state of flux in South Africa. In the recent past, in most urban areas the focus of public transport bodies was largely the provision of basic services for low-income communities, whose travel choices do not extend to walking, cycling or driving to their destinations. In most medium- to high-income areas, only rudimentary services exist which can barely be considered an alternative to the motor car. Accordingly, public transport services in South Africa have been designed to serve the perceived need to assemble labour from distant suburbs and satellite low-income dormitories, at centralised workplaces. There were, and still are, very few off-peak services. Public transport to serve non-work trip purposes has also been neglected. In recent years, public transport has come to be dominated by minibus taxis, which do not run to schedule and which have tended to follow the line of least resistance through the townships and settlements, in order to give operators the opportunity of maximising the number of journeys, and thus their profits. Service to customers has not been of primary concern.

The foregoing is the public transport context within which the planners of new settlements will be operating in the short to medium term (the next five to ten years). Settlement planners[1] will, however, be challenged to assist transport authorities[2] in changing direction and building cities and towns which facilitate public transport, and make it more accessible, viable and sustainable. It is, therefore, essential that the planners of settlements in urban areas should understand the current and evolving public transport policies so that they can assist in facilitating settlement which is supportive of public transport. This guide does not deal with settlements in rural areas, although many of the principles and standards are applicable.

The next section provides a summary of relevant documentation about public transport, and gives an indication of the likely directions of change in the coming ten years, to provide settlement planners with an understanding of the context within which settlement planning will be undertaken.

EVOLVING PUBLIC TRANSPORT POLICY AND ITS IMPLICATIONS FOR SETTLEMENT-PLANNING

White Paper on national transport policy

The strategic objectives of the White Paper which are relevant to settlement-planning and which should be incorporated in future settlements are summarised below:

- Public transport travel distances and times for work trips should be limited to about 40 km, or one hour in each direction. This means that new settlements should be located no further than 40 km from the major work destinations. Further, as a general guideline, settlements should rather be located as close as possible to places of work and other urban activities so as to facilitate trips by bicycle or on foot. Where this is not possible, settlements should be located close enough to work destinations to enable public transport vehicles to make two or more trips from the settlement to the work place or school in peak-hour periods.

- An objective has been set to promote the use of public transport over private car travel with an ambitious 4:5 ratio of public to private transport being set as a target. To assist in the achievement of this objective, settlement plans should have circulation systems or movement layouts which make all dwellings accessible to public transport (see Sub-chapter 5.1).

- Within the strategic objectives for improving accessibility, a target has been set of reducing walking distances to public-transport facilities to less than about one kilometre. Most people take about 15 minutes to walk one kilometre, so this objective should be regarded as a minimum. A far more desirable target for settlement-planning will be to place every dwelling within about seven minutes of a public transport boarding point (around 400-500 m).

- A final strategic objective which should be taken into account in settlement-planning is the object of promoting and planning for the use of non-motorised transport. Accordingly, settlements should be planned as places with a variety of urban activities, containing workplaces, schools, shops, recreational and community facilities, and dwellings. They should also have movement networks which permit direct pedestrian access to activities and public transport facilities (see Sub-chapter 5.1).

1 This applies to all professions involved in the planning and design of settlements.

2 Transport authorities are provincial or municipal governments responsible for pubic transport and roads in terms of schedule 4 of the constitution of the Republic of South Africa Act of 1996.

The White Paper also contains a number of policy statements that should be taken into account in settlement planning. These include the following:

- Land-development proposals (which include settlement plans) should be subject to a spatial policy framework within an agreed development-planning process. This means that the settlement plan must be approved in terms of an integrated development plan (IDP), part of which is an integrated transport plan (ITP)[3]. Accordingly, settlement planners will, at the outset, need to consult transport authorities to ensure that the planned settlement will be complementary to the integrated transport plan (ITP), which includes public transport strategies and operations.

- Land-use development at local level (settlements) will be subject to development approval in conformity with integrated development plans.

- The settlement plan should be cognisant of the designated public transport corridors and nodes contained in regional, metropolitan or urban IDPs. Thus, it will be necessary to contextualise the settlement within such a spatial plan. Every new settlement will be either adjacent to, or distant from, a major line-haul public transport corridor (in rare cases the public transport corridor may even bisect a settlement). The form of the settlement should be strongly influenced by its spatial relationship to line-haul public transport corridors, modal interchanges and feeder corridors; in this regard, specific guidelines on planning principles and design standards will be provided in later sections. At this juncture, it is sufficient to note that in terms of the White Paper, settlement plans will need to give effect to the policy of locating employment activities within (or close to) the public transport corridors and nodes (interchanges). Likewise, the settlement plan should facilitate the provision of higher density and mixed land uses adjacent to public transport facilities.

- A high density of development is important for public transport, in that it supports differentiated public-transport provision and enhances operating efficiency.

Legislation

Local government and transport legislation is in the course of preparation and will establish institutions and planning processes and procedures that will give effect to the White Paper's objectives and policies relating to both urban settlement and public transport. It can be expected, however, that local government, land development and land transport legislation will seek to promote integrated planning. This means that settlement plans will be subject to policies set out in integrated development and transport plans, as indicated earlier. Accordingly, in the short term, settlement planners can be guided by the objectives and policies set out in the White Paper which will, in due course, be given effect through the Land Transport Act. An important component of the Act will be the establishment of transport authorities, who will be responsible for planning for public transport. Settlement planners must consult transport authorities as an essential part of the planning process.

Moving South Africa

Moving South Africa (MSA) (South Africa, Department of Transport 1998) was a project of the National Department of Transport, completed in September 1998, which aimed to develop a long-term transport strategy for South Africa. The strategies identified in MSA entitled "Towards a transport strategy for 2020", will impact on settlement-planning. Appendix C to this sub-chapter contains a summary of these strategies. The following are the main features of MSA which are significant to settlement-planning:

- Line-haul, mass public transport will be concentrated into relatively few public transport corridors to provide conditions that will attract high-density mixed land uses. It is expected that most new urban employment activities will be encouraged to locate within such corridors.

- The quality of public transport and the extent of social support for the services will depend on the market segments served in each of the corridors. Settlement planners should thus be aware of the customer segmentation in the settlement, as this will provide an indication of the type of service that can be expected.

- Moving South Africa has developed a broad set of guidelines for determining the type of public transport infrastructure which will be appropriate to each corridor. These are only guidelines because, in due course, transport authorities will examine corridors on their own merits and determine their particular public transport policies. The guidelines will, however, influence settlement-planning. They are as follows:

  - High passenger-volume (also referred to as "ridership") corridors with more than 40 000 passengers per direction per day will probably support a rail - or dedicated public transport road - infrastructure in congested areas. Public transport nodes (stations and interchanges) in these high-ridership corridors will be supported by feeder services rendered by buses or minibus taxis.

[3] An Integrated Transport Plan is defined in guidelines prepared by the Committee of Land Transport Officials (COLTO).

- Moderate-ridership corridors with 10 000 to 40 000 passengers per day per direction are likely to be served by a road infrastructure, with priority or dedicated lanes for public transport over parts of the corridor. The line-haul services in these corridors will largely be provided by buses, supplemented by both buses and taxis at nodal public transport interchanges.

- Low-ridership corridors will characteristically have fewer than about 10 000 passengers per day per direction, and are likely to have some road-based priority schemes. Many of these low-ridership corridors will be feeder corridors. All the roads can be expected to be paved and the line-haul function or feeder function will fall primarily to taxis or small road-based vehicles.

Settlement planners will need to ascertain where the existing public transport corridors are located, relative to the proposed settlement. In planning the settlement it will be necessary to ascertain the type of corridor that will serve the settlement. This means negotiating with transport authorities to identify whether there will be extensions to nearby line-haul services, or whether the settlement will be served by a feeder service. In the case of the latter, the location of existing nodal points and modal interchanges will be an important consideration in the alignment of the low-ridership feeder corridor serving the settlement. Likewise, the location of the corridor or feeder facility within the settlement will need to give cognisance to the accessibility standards discussed earlier.

Figure 5.2.1 shows the urban densification options considered by MSA. MSA notes that high central-city densities will enhance public transport use and sustainability, but in South Africa this solution is problematic due to historic land tenure patterns.

MSA notes that the tendency towards continuing decentralisation of workplace locations is complicating the task of creating "compact cities". While it is argued that some compaction may be achievable as a means of increasing density in some cities, and is not ruled out, it is suggested that the predominant pattern in South Africa should be the "corridor city". MSA argues that the corridor approach fits more easily with existing South African urban land-tenure patterns. The appropriateness of the corridor approach is driven not only by the already decentralised distant townships and the low density of inner-ring suburbs, but also by recognition of the decline in central business district (CBD) vitality and the dispersion of development to satellite nodes. The favoured corridor option recognises the existing vacant land between townships and suburban areas which should be taken into account in settlement planning. These areas, if developed, can build on existing flows on major current corridors.

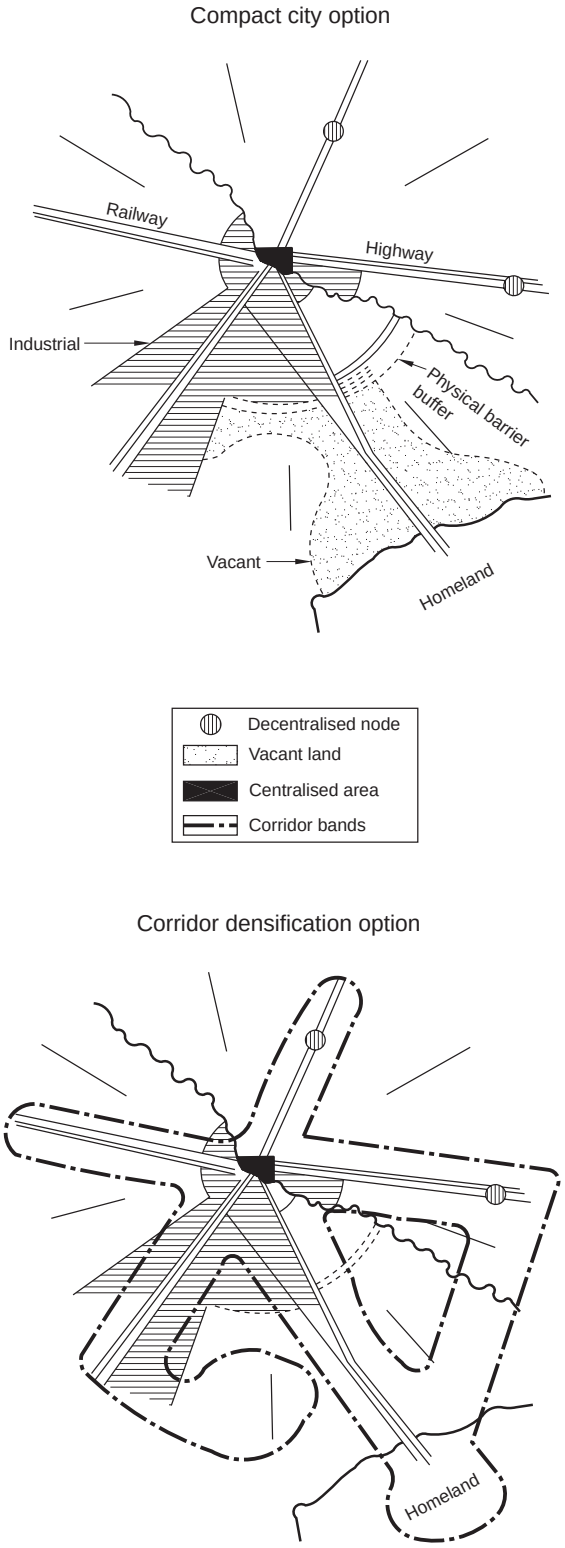


Figure 5.2.1: Urban densification options
Source: South Africa, Department of Transport (1998)

MSA states that corridors already exist to some extent in South African cities and, accordingly, their strategy focuses on densification of existing corridors and the creation of new corridors for future urban settlement-planning. The short-term focus should be on reigning in the centrifugal tendencies in South African cities to

prevent the future dispersion of development. MSA will be looking for strategies to attract decentralising activity towards public transport corridors. This approach should have a strong influence on settlement-planning.

PRINCIPLES TO ACHIEVE THE FUNDAMENTAL RESTRUCTURING OF PUBLIC TRANSPORT

The Department of Transport, through the CSIR, is currently assessing the processes and actions necessary to achieve a fundamental restructuring of urban public transport and create sustainable high-priority public transport systems.

Settlement planners may take it as given that the objectives, policies and strategies outlined in the preceding sections will be pursued through transport policy implementation, which should begin to shape ITPs as part of the process of urban development. The ideal of an interconnected network which serves a variety of destinations and is fully integrated will require a number of interventionist strategies and a supportive land-use structure. Evidence from cities such as Curitiba (Brazil) and Singapore suggests that this can be achieved only through strict adherence to principle and through an approach based on a committed spatial and network form.

The principles for fundamental restructuring are the following:

- *Problem-solving approaches and programmes for restructuring public transport should be incremental, practical and focused on the long-term vision (the corridor form of urban development)*

  Within this principle there are two aspects with a land-use or settlement dimension:

  - Public transport efficiency criteria are the key to the development of land-use. In time to come, transport planning and travel-demand management will impact on spatial patterns in South African cities, helping to make the urban land market more responsive to public transport as a locational determinate.

  - The high-priority public transport network will form the structural component for focused spatial development initiatives. Decentralised, retail and industrial developments and their relation to new settlements should be viewed as key elements in support of bidirectional public transport flows. This will require a review of decentralisation node location, as future design will be geared towards compact decentralisation nodes.

  A public-transport priority network should be developed (a few lines with frequent service are preferable to many lines with infrequent service). This will mean that settlement planners should note that, in most instances, the public transport component of new settlements will be feeder services and transfer nodes, except where the settlement falls within one of the higher-density corridors.

- *Appropriate nodes and technology should be selected to provide cost-effective services at predefined service levels, based on principles of efficiency*

  The public transport corridor and modal hierarchy will be assessed in terms of the length of the corridor, the convergence of routes and the relationship to the surrounding routes. For this reason it will be necessary for settlement planners to consider more than just the nearest point of access to public transport for the settlement. It will be necessary to understand the entire transport network or system when plugging a new settlement into any urban area.

  Settlement planners must be aware that public transport routes may be upgraded from feeder or low-priority routes to high-intensity lines or routes over time, as the urban area grows. Accordingly, the settlement must be designed with some flexibility to facilitate the application of different technologies as the demand at particular nodes and along the corridor grows. Where public transport routes are planned as part of the settlement plan, the demand implications of nodes and the potential for concentrations of land use along the corridor length, should be given attention during the planning of the layout.

- *The potential for transfer between routes should be maximised*

  Modal transfer centres will serve as the focus for the high-priority public transport network. Where such points lie within - or at the edge of - a settlement, they should serve as focal points for the movement network in the settlement. Pedestrian, cycle and public transport feeder roads should converge radially on central transfer points, which should be designed as pedestrian-friendly. To ensure that these points do not become clogged by standing and waiting buses and minibus taxis, separate holding areas should be provided in the settlement. Care must be taken to design the holding areas so that they do not cause unsightly impediments to movement within the settlement. The nodal transfer centres, whether stations or road-based interchanges, should be planned and managed as mixed-use centres, containing retail

facilities, offices, community services, and even some residential activities.

- *Seamless services that contribute to the concept of a centrally operated and controlled public transport system should be developed*

  Seamless services have a uniform and shared fare and ticket system applied to all modes, and customers can transfer between travel modes with a minimum of delay and discomfort. This principle can be supported by settlement planners if they ensure that a public-transport network, or potential network, is provided which is direct and which is physically conducive to comfortable and convenient transfer. In the design of the transport network, every effort should be made to make the route and facilities associated with it highly visible and accessible to the community.

- *Commercial, retail and industrial development activities should be located at appropriate nodes (convergence points on the public transport network), preferably within the priority corridor structure*

  These spatial components of the fundamental restructuring of public transport are illustrated in Figure 5.2.2, which highlights the principles that should be applied to achieve fundamental restructuring of public transport. Settlement planners should be cognisant of the need for public transport nodes to be prioritised in terms of their location relative to the high-priority network, and should be based on meeting certain minimum thresholds of demand. A clearly defined approach to settlement land-use planning is necessary for the support of an efficient, structured public-transport system. Nodes which fall short of the threshold of demand necessary to support a high-frequency public transport service should have further development discouraged within them, both by zoning regulation and the use of incentives and disincentives. This means that settlement planners need to understand at the outset what the public transport thresholds are, and should obtain this information by consulting transport authorities about their standards for public transport in the vicinity.

  Existing townships, particularly dormitory townships, provide a special case in terms of nodal structure. It is important that settlement planners who will be responsible for extensions of townships and infilling should understand that these types of settlement generally lack any kind of economic or activity node. They are, however, powerful

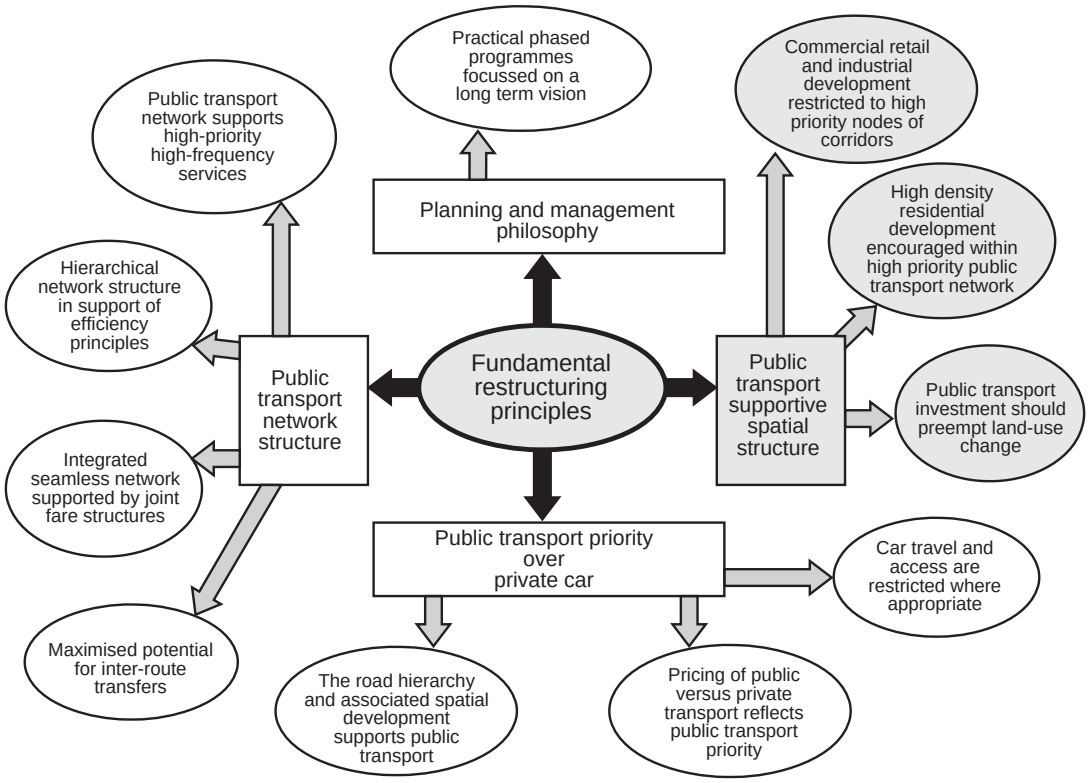


Figure 5.2.2: Principles to achieve the public transport supportive structure necessary for fundamental restructuring
Source: Shaw (1998)

generators of demand for public transport. For this reason it is suggested that potential nodes[4] be identified within or immediately adjacent to township areas. Under ideal circumstances, employment and amenity-related growth should be located at these potential nodes. It must, however, be recognised that developers may be resistant to considering investing in such nodes, thereby constraining the ability to develop efficient bidirectional ridership patterns. The settlement plan should make space available for the relevant nodes to develop, even though there may be resistance to invest at the outset.

- *High-density residential development should be encouraged within the priority high-frequency public transport corridor structure*

Settlement planners need to understand that higher-density residential development should be encouraged on unused or under-utilised land within the corridor structure of the high-priority public transport network. While it is recognised that the current South African housing delivery process does not encourage high-density development, one of the most significant future challenges to settlement planners will be to find delivery mechanisms and design solutions that promote higher-density residential development as a support mechanism for more efficient public transport. This should apply particularly to the areas adjacent to high-frequency public transport corridors and to nodes within all types of public transport corridor.

- *Public transport priority and infrastructure investment should pre-empt initiatives with respect to land-use*

In the urban areas of the future, as the primary and feeder public transport route network is developed there will be a need for flexibility in the network within settlements to enable lesser traffic routes to be upgraded as demand increases. This is not to say that large reserves need to be set aside to accommodate possible future public transport, but that the internal circulation or movement system should be designed so that ultimately road-based services can be provided with stops at 800 to 1000 m intervals, with each of the stops having nodality and good access to the surrounding settlement for pedestrians.

- *The road hierarchy, and the association between this hierarchy and spatial development, should support public transport*

Settlement planners should be cognisant of the negative aspects of creating car-orientated "closed" road networks which are designed to inhibit through-traffic. Provision must be made for the penetration of neighbourhoods by public transport. The road hierarchy should promote direct public transport routing and, where necessary, public transport priority, and encourage suitable pedestrian access to surrounding land uses. Small residential cells may be designed as "closed" networks, providing that cycle and pedestrian through-movement is facilitated (for details see Sub-chapter 5.1).

In considering the public transport routes through or adjacent to a settlement, settlement planners are reminded to give consideration to the current and proposed future function of the route, whether a primary public transport corridor or a feeder corridor. There is a need to separate the primary public transport route from the private car-based arterial road network, and vice versa. Public transport priority and a public transport supportive road hierarchy are essential to the success of the promotion of high levels of service for public transport. Unfortunately, attempts to give priority to public transport over a considerable portion of the road network are unworkable because of the extensive coverage which would be needed. It would only be possible where there was really significant demand for public transport. However, areas of the network offering the highest accessibility need to be transferred from mixed-traffic conditions to dedicated rights-of-way for public transport.

If there is to be a priority node and/or corridor within a settlement, the planner should note the need to make a distinction between the core and the frame of the high-priority node. The core should be identified as the area of the greatest pedestrian activity. Parking should be omitted from the core in favour of dedicated pedestrian activities. Parking facilities may be provided within the frame of a node.

One of the most significant components of settlement planning in support of public transport in the future will be decentralised nodes. The planners of new settlements need to ensure that nodes with large commercial floor space should not be provided in areas not served by public transport.

[4] A potential node is a point in a public transport network where the public transport movement is concentrated and transfers from one travel mode to another take place, providing conditions conducive for local economic development, based on the traffic at the node.

Thus a settlement unconnected to the primary or feeder network through nodes should not be developed as a decentralised activity centre.

- *The pricing of public versus private transport should reflect public transport priority*

  Settlement planners need to recognise that a targeted approach towards the management of both accessibility and the associated form of the public transport is needed. A key element in the future management of accessibility in building South African cities will be to move away from an approach in which infrastructure improvements are commissioned to relieve congestion, irrespective of location. In future, infrastructure improvements should be based on the enhancement of accessibility, particularly by public transport.

- *Restrict car travel and access under appropriate circumstances*

  Settlement planners should restrict motor vehicle access within CBDs and other nodes. Along high-priority public transport routes the access of pedestrians to fronting properties should be promoted, whereas vehicle access should restricted.

The Phase One report of the Department of Transport's fundamental restructuring project contains an assessment of four alternative city forms with associated public transport network structures. The results, highlighted in Figure 5.2.3 provide settlement planners with an overview of the impact of different city forms on passenger-volume conditions, average transfers per trip, trips per capita and the directional mix of traffic. Settlement planners should, therefore, take pains to understand the network to which the settlement is to be attached.

PUBLIC TRANSPORT OBJECTIVES

The following objectives should be applied to give effect to the principles outlined in the preceding section, and to ensure that the settlement is conducive to the provision of efficient and convenient public transport:

- providing for an urban structure of walkable neighbourhoods clustered together to form towns and cities of compatibly mixed uses, in order to reduce car dependence for access to activities;

- ensuring that walkable neighbourhoods and access

Example of four public transport network concepts

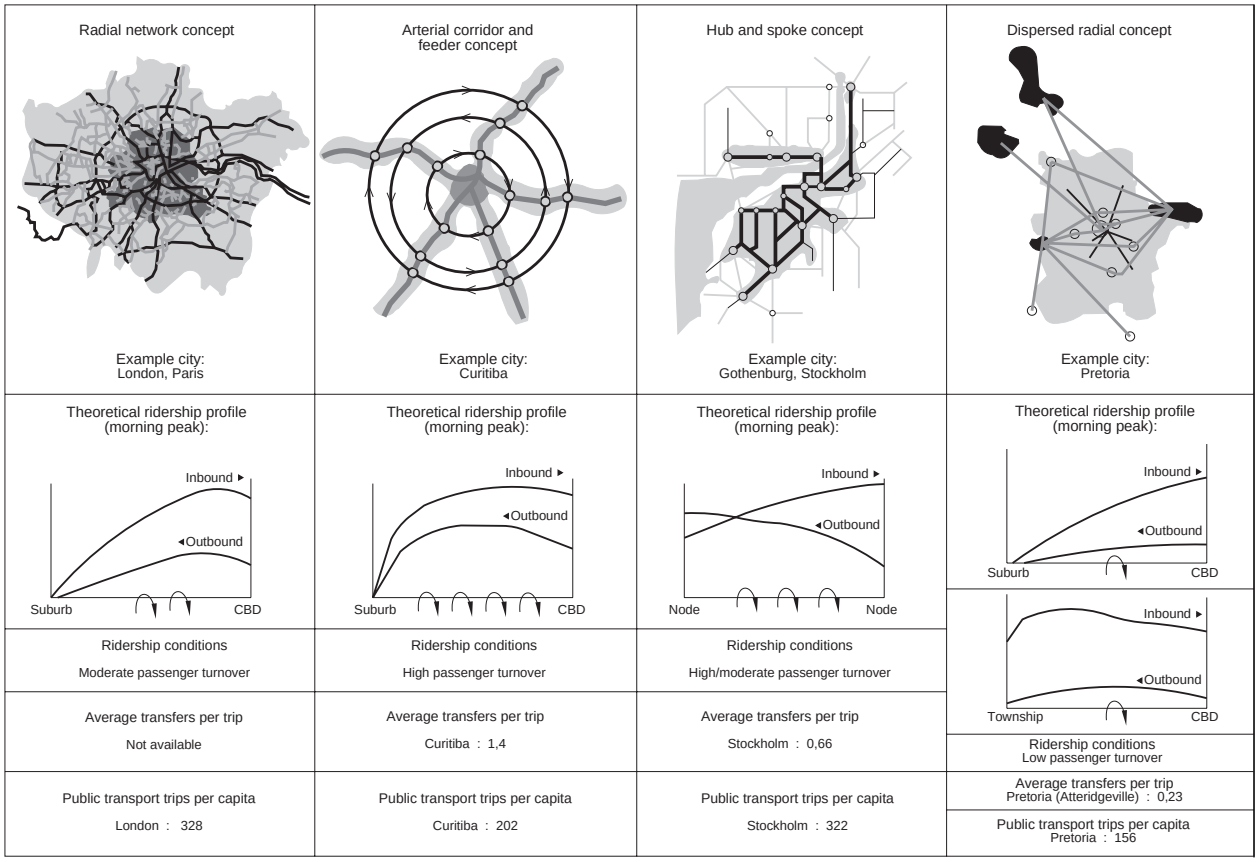


Figure 5.2.3: Example of four public transport network concepts
Source: Shaw (1998)

to services and facilities are designed for all users, including those with disabilities;

- facilitating development that supports the efficiency of public transport systems, with safe and direct access; and

- providing a variety of plot sizes and housing types to cater for the diverse housing needs of urban dwellers at densities that can support the provision of viable public transport.

The design and layout of a settlement can have a profound influence on its sustainability. A number of objectives need to be pursued which will contribute towards creating living environments that are more affordable for residents. The design should

- reduce dependence on cars by encouraging walking, cycling and the use of public transport; and

- give access to facilities for all users of the environment, and provide opportunities for locally based business and employment.

As a global phenomenon, recent neighbourhood design concepts have been given titles such as "transit-oriented design" (TOD), "traditional neighbourhood design" (TND), "green-house neighbourhoods" and "urban villages". In each case the underlying objective is to create neighbourhoods which reduce dependency on private vehicles and are more energy-efficient.

GUIDELINES FOR PUBLIC TRANSPORT SUPPORTIVE SETTLEMENTS

Planning settlements that are accessible to public transport

The process of planning for public transport includes site and contextual analysis, right down to the details of street alignment and form, plot sizes and shapes. The "coat-hanger" around which the settlement should develop is the public transport network. This should be supported by a movement network which should, as a priority, facilitate multi-directional pedestrian movement, focused on a highly accessible public transport system.

In respect of the public transport component of settlement-planning, the planning should take account of and address the following questions:

- How big is the settlement, how will it be developed and at what density?

- Where is the settlement, relative to the main activities in the urban area in which it is situated?

- Where is the settlement located relative to existing public transport, either rail- or road-based?

- How will the settlement be connected to the existing public transport network, whether road or rail or both?

- Will the settlement be sufficiently large for the main public transport line-haul system to be extended through it, or will it be located to one side of the major public transport route, or at some distance from the corridor, requiring a feeder public transport service?

- What will be the likely demand for public transport generated by the settlement?

- Where will the main access to public transport be within the settlement?

- What will be the spacing of public transport stops in the settlement?

- How can the settlement be planned so that the movement system provides the maximum access to public transport?

- What is the relationship between the movement system for the settlement and the proposed public transport services?

Obviously, these and other questions will inform the planner with regard to the integration of the movement and public transport networks. Specific guidelines on the site and contextual analysis, as they relate specifically to public transport, are provided in the following section.

Contextualisation and connection

This should be undertaken at an early stage to identify opportunities and constraints presented by the site. The processes take into account all constraints - such as open space, topography and servitudes - and include an analysis of the regional structure and neighbourhood form in existing surrounding areas. Of relevance to the public transport planning is the following:

On a map (as exemplified in Figure 5.2.4), and where relevant, quantify the following information:

- existing and planned neighbourhoods, towns and regional centres;

- other significant features such as regional parks;

- freeways, arterial roads, public transport routes, bus stops and rail stations; and

- the location of rail stations.

Map, describe and where relevant, analyse, the following information:

- servitudes and street reserves;
- linkage to and from the site;
- distance and direction to public transport infrastructure; and
- distance and direction to local shops and schools.

The foregoing context and site analysis applies only to public transport. Obviously there are other contextual and site-analysis factors which need to be taken into account by settlement planners, including topography, drainage, vegetation, etc.

Figure 5.2.4 exemplifies the concepts of contextualisation and connection. It shows the site and the spatial relationship between the site and existing urban development, indicating the location of the main transport infrastructure, existing and future roads and road reserves and future developments of

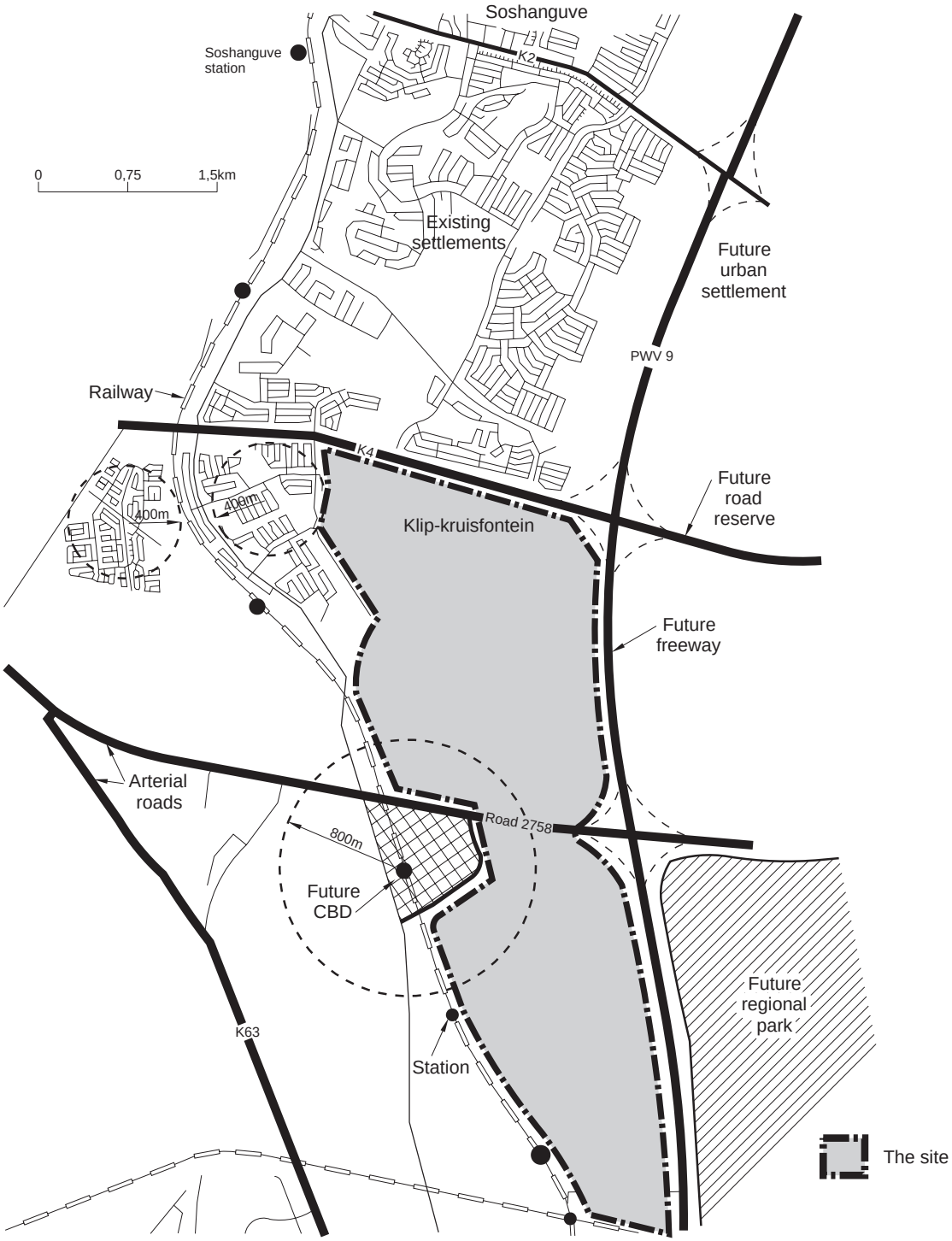


Figure 5.2.4: Context and site analysis map

regional significance, such as a future CBD and rail station and a future regional park. This example is superimposed on an actual settlement, but the elements (such as the proposed future regional park) are hypothetical. The figure illustrates some of the site conditions that will influence the movement and public transport network. Topography and the influence of slope are not shown, but the planner is cautioned to note the importance of topography to the public transport movement system (see Sub-chapter 5.1). It is obvious from this context and site analysis how the site needs to be developed to tie in with the existing settlement and infrastructure. The freeway shown in the figure represents a constraint on the development of the site. This constraint would require settlement planners to negotiate with road and/or transport authorities, to provide measures to eliminate severance and to help minimise the environmental impact of the freeway on the development of the settlement. In this instance, settlement planners should persuade road authorities to provide freeway bridges or underpasses to link the communities on either side of the freeway. In the situation depicted in the figure, the entire layout and settlement plan will be influenced by the number and type of movement connections which the road authority may be willing to provide. Different circumstances will prevail, and there may be cases where the local authority or transport authority will require the site developer to pay for providing linkages. This decision usually hinges on the stage of the planning of the future freeway.

Public transport framework

Planning information requirements should address - but not be limited to - the following matters:

- the contents of the Integrated Transport Plan, including policy statements on the public transport network, rail concessions, bus contracts, minibus initiatives and public transport infrastructure;
- public transport demand (the origins and destinations of trips) the placement of bus routes, proposed bus stop locations (including calculations of walkable catchments served within a 400 metre radius);
- all existing/proposed rail station locations (including calculations of walkable catchments served within an 800 m radius;
- provision for pedestrians and the disabled;
- an actual or potential cycle network plan;
- layouts to facilitate effective traffic management around schools and to facilitate safe access to schools;
- traffic management in and around proposed activity centres;
- measures to control traffic speed; and
- proposed intersection controls, including priority systems signalled by the use of a clear movement hierarchy.

Guidance on the technique to use walkable catchments as the basis for accessibility planning and calculating catchments is listed in Appendix A. Examples of processes for restructuring public transport demand for different settlement types and market segments are provided in Appendix B.

An example of the recommended process for the development of settlements supportive of public transport is illustrated in Figure 5.2.5.

In consulting with transport authorities to ascertain future proposals in respect of road and rail infrastructure, as well as public transport services, the planner is cautioned to note that, in some cases, the settlement should influence and modify planned transport facilities. Some hard-nosed negotiation may be necessary. A hypothetical public transport framework is illustrated in Figure 5.2.5.

It will be noted from Figure 5.2.5 that the main public transport corridor is to be found to the west of the settlement and comprises a commuter railway line, which provides for long distance movement, and a "road-based" activity spine within the corridor, to provide for regional movement between stations and between different districts of the urban area. In this case, the location of the road-based activity spine may be questioned because it duplicates and competes with the rail service. An alternative location further to the east and bisecting the settlement may be preferable, to provide a viable threshold for the road-based public transport service. The regional, road-based "activity spine" needs to be well connected to the rail at interchanges and stations. The figure depicts a future station at the centre of a proposed future central business area. Such a station should be served by feeder road-based public transport in which case there will be a need to plan for a public transport, interchange to facilitate this process. Although not part of the settlement plan, the station and the public transport interchange will exert a strong influence over the road alignments in the settlement, as depicted in the figure. The technique of using 800 m catchments around stations, and 400 m catchments around bus stops, has been used to provide the structuring elements or transport framework for the settlement. The figure shows the activity nodes in the centre of the public transport catchments, which are the focal points on the feeder routes and should be spaced at 800 m intervals. Such a design will provide for flexibility, even if feeder routes are not initially

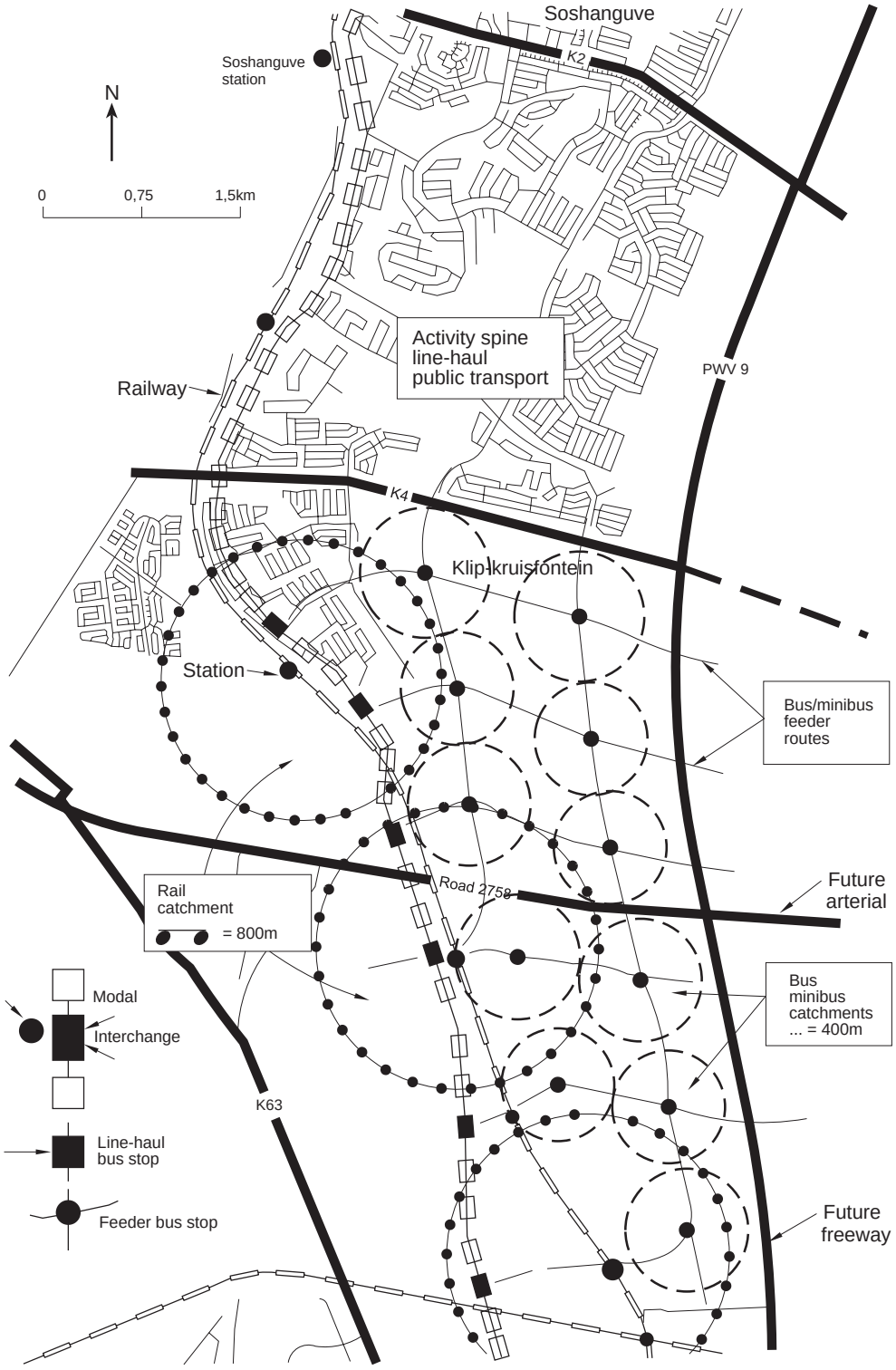


Figure 5.2.5: A transport framework for settlement planning

provided in both directions. For example, the bus stop spacing could initially be lower on the activity spine, with all feeder routes from the settlement feeding into the public transport interchanges, associated with rail stations rather than into stops at 800 m intervals on the activity spine as indicated in the figure.

It is important that flexibility should be provided in the design. It will be noted that the transport framework has made provision for the freeway to be crossed at around one kilometre intervals. This is an important principle and standard which should be adhered to in urban areas in order to minimise severance and the environmental impact of freeways.

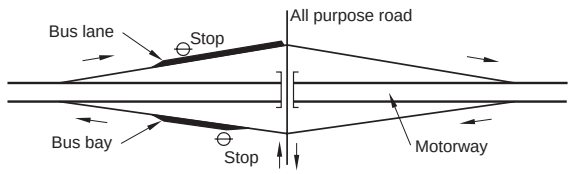
Integration of public transport and movement networks

When designing a movement network in support of the public transport network, the different patterns of movement of buses, freight vehicles, cars, bicycles and pedestrians should be borne in mind (the reader should refer to Sub-chapter 5.1 for guidance on movement networks). Typically, cars and goods vehicles seek to make direct journeys at the highest possible speed. The aim should therefore be to get these vehicles from a neighbourhood to a through-route as quickly as possible. Buses and minibuses, on the other hand, are required to serve passengers and to offer an attractive and convenient alternative to car travel. Buses should be able to proceed directly through the centre of neighbourhoods, picking up and setting down passengers as close as possible to their origins and destinations.

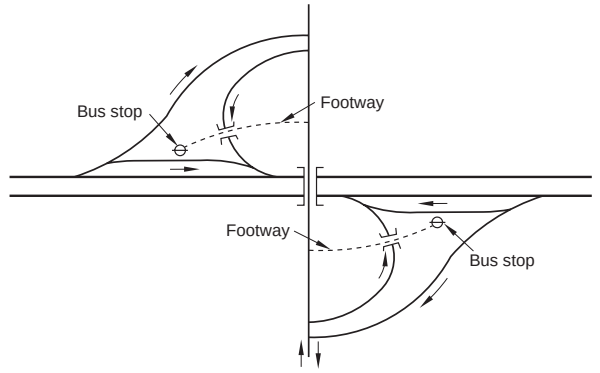
Buses and minibuses normally travel along public roads shared with other traffic. Such roads are usually classified by traffic engineers within a functional road hierarchy. Bus operations can be expected to be found on many of the strata. Accordingly, settlement planners should provide public transport networks on roads on which the traffic functions and characteristics of the road are harmonised with the moderate speed, mixed-traffic and pedestrian-crossing requirements of such a facility. Guidance on public transport in relation to the road hierarchy is provided below:

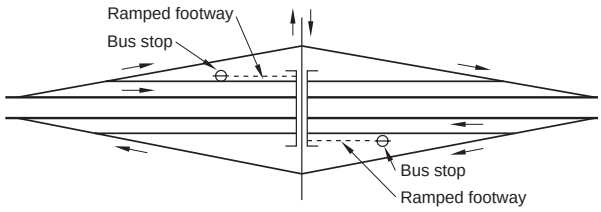
- *Major arterials*. The arterial network in intended to accommodate major traffic movements and to link the major districts of towns and cities. "mobility" routes, which have a limited number of interchanges or intersections and a large degree of access control to fronting properties. Major arterial roads such as urban freeways and dual carriageways are not suitable for bus services and should only be used for limited-stop and express services. In the case of limited stop and express services operating on freeways, stopping places may be provided as indicated in Figure 5.2.6.

- *Minor arterials*. Minor arterials feed traffic from the major arterials into and from the main urban districts and provide the linkage between them. These are generally the ideal roads for line-haul bus and minibus taxi movement. While there are usually some restrictions on frontage access and restraints on street parking on this type of road, particularly during peak hours, the standard of intersection spacing tends to be lower and there is considerable cross-traffic and pedestrian movement, and there are many pedestrian footways at the roadside. The amount of interaction and cross-traffic produces a reduced speed differential between buses and other traffic, meaning that buses can stop at the kerb without causing undue delay or danger for other road users. Bus lay-bys should, however, be provided, and in congested areas on this type of roadway priority lanes should be provided for road-based public transport.

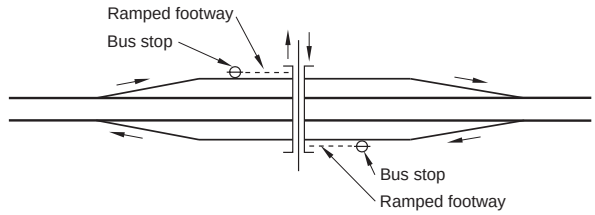


(1) Bus stops on interchange slip roads (for services entering or leaving an urban motorway)





(2) Bus stops for through services at an interchange



(3) Bus slip roads and stops at points between interchange

Figure 5.2.6: Location of bus stops on major arterial roads of freeway standard
Source: Greater Glasgow PTE (1973)

- *Collectors*. Collector roads are the link between the urban main road system (arterials) and neighbourhoods. These should penetrate the neighbourhoods and, together with minor arterials, are the appropriate level in the road hierarchy upon which public transport services, particularly feeder services, should be provided.

  The majority of stopping bus and minibus feeder services will be found along the collector type of

road, which should preferably be at least 7,3 m wide. Widths in excess of this tend to encourage higher speeds which are not desirable on mixed-traffic facilities.

- *Activity streets.* Hitherto, such streets have not formed part of the urban road hierarchy and have not been planned, but have evolved. They are streets that experience mixed traffic and intense fronting land use activity. Many activity streets start life as high-mobility arterials but, because of their high accessibility, become congested and attract commercial land use. Access-seeking traffic begins to predominate over through-traffic. Activity streets are the ideal locus of road-based public transport services. Settlement planners should provide layouts and land-use plans which facilitate the emergence of "activity streets" as the basis of public transport corridors. The scale, geometric characteristics and dimensions of an "activity street" cannot be specified prescriptively. An activity street could vary from collector-road scale, with a narrow cross-section, typical of a European village "high street" to a minor arterial in a generous cross-section. Typically, there should be interaction between one side of the street and the other, with much pedestrian crossing, so the scale of the street should be modest.

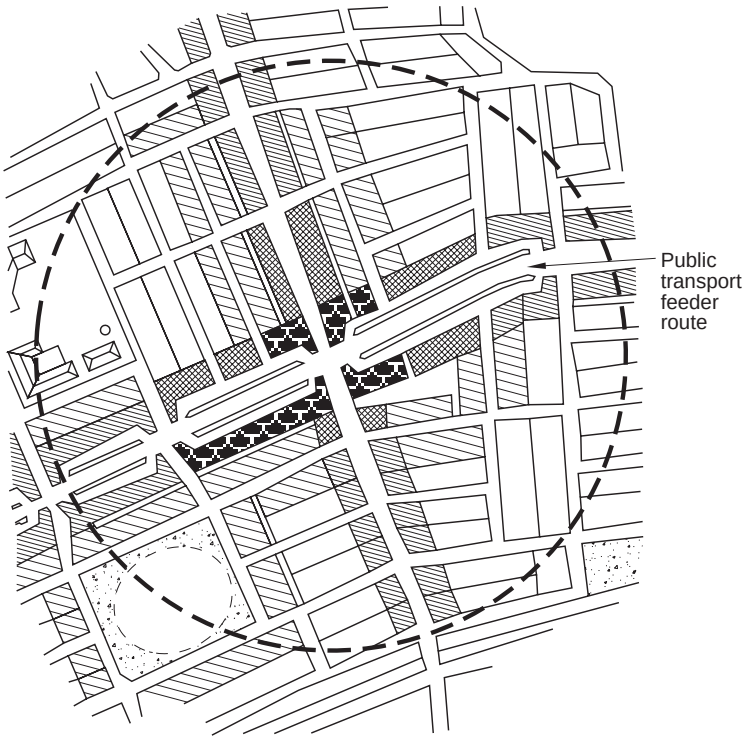
- *Local (access) streets.* Public transport should be precluded from using this type of street, which should be designed to facilitate mixed traffic within neighbourhoods in safety and at low speed.

The specifics of the design and layout of the road and movement networks are dealt with in section 5.1.

The following section provides some additional guidelines in respect of the local road and movement networks in relation to public transport. Figure 5.2.7 shows a public transport feeder route bisecting a neighbourhood unit with a radius of 400 m. The centre, or point of highest accessibility, is the point at which public transport services will be provided. It is evident from the layout that, because of the open road network, public transport is highly accessible along the public transport route. The figure also indicates that, ideally, higher-density mixed land-use should be provided adjacent to the route. It also shows that service roads can be provided for access to fronting shops.

Figure 5.2.8 shows a variation of the same network to illustrate the point that intensive neighbourhood activity should be located at the centre or most accessible part of the neighbourhood, whereas more extensive activity, some of which may have an inter-neighbourhood function, may be located further away at the periphery, but will still be accessible on foot, to residents in the neighbourhood. An example of the latter is a primary school.

Figure 5.2.9 shows a "closed" street network which is characteristic of residential networks provided in the recent past. This type of network is a "car-oriented network" in that pedestrian movement is channelled along the streets and the only access to the central



"Open" movement network with high density mixed land use in support of public transport

Figure 5.2.7: A public transport feeder route in an open network
Source: WAPC (1997)

"public transport road" is the intersection at the centre of the figure. It is evident that such a layout will be inconvenient to pedestrians, particularly those trying to access the central road from the closed loops.

The "closed" network depicted in Figure 5.2.9 can be modified to facilitate pedestrian access to the central public transport feeder routes at appropriate points, while retaining the closed road network which precludes through traffic (see Figure 5.2.10). This is by means of mid-block pedestrian or cycle gates placed at strategic locations on the facility. The figure also shows bus lay-bys provided in a widened reserve at the most accessible point. Such "closed" street networks may be desired by some communities as an impediment to vehicle-based through traffic, and to preserve the security and or environmental benefits of closed networks. Settlement planners should, however, bear in mind that open networks designed with appropriately scaled reserves and narrow roads tend to inhibit through movement and have greater flexibility. Through traffic tends to be curtailed where space for parking is limited and the streets are designed to facilitate pedestrian movement, street parking and slow vehicle movement.

The foregoing examples provide some guidance as to how the public transport framework interfaces with the neighbourhood movement and street networks.

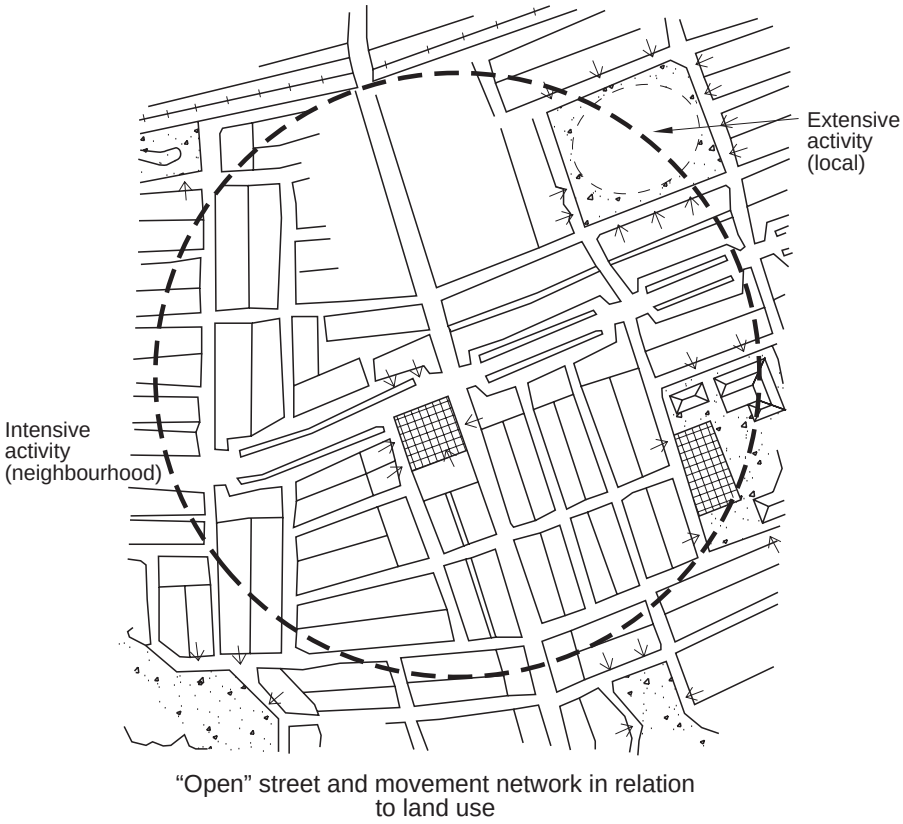


Figure 5.2.8: A public transport feeder route in relation to neighbourhood activities
Source: WAPC (1997)

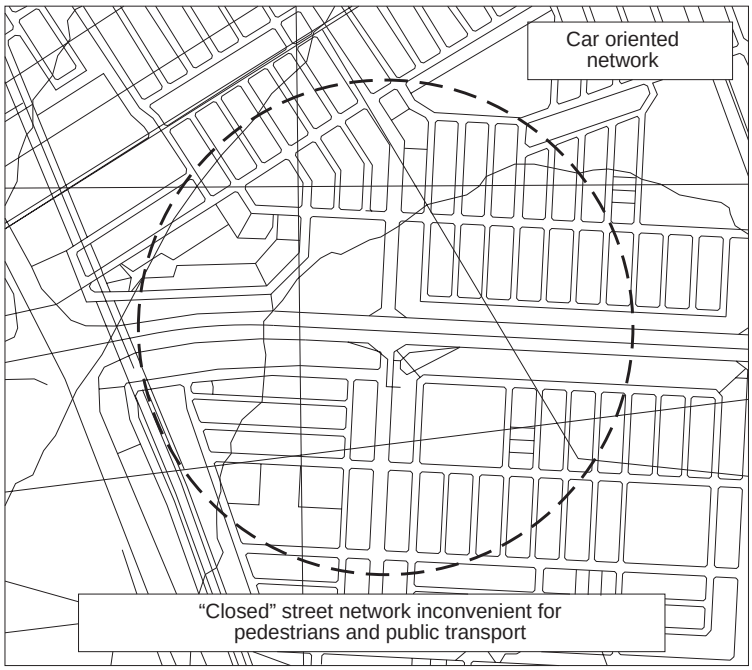


Figure 5.2.9: Car-oriented network

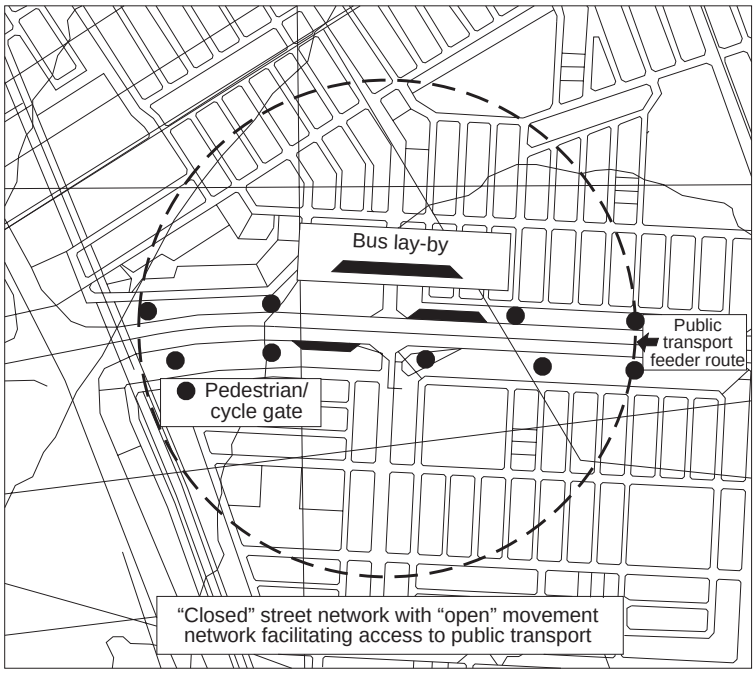


Figure 5.2.10: Modification of a closed road network to provide an open movement network

Integration of land use and public transport

Land-use elements

To attract customers to public transport, planners need to understand the influence of land use and urban design on travel behaviour. As indicated in the previous section, better integration of land use and public transport is possible when public transport considerations are included in settlement planning. Municipalities have the legal authority and regulatory instruments to enforce urban development that is supportive of public transport. In terms of integrated development plans, it is important that development proposals should be reviewed in the light of traffic generation, potential public transport ridership, and ease of operation for public transport. This section of the guidelines describes what public transport-oriented land development means in terms of urban structure, road networks and design standards which are favourable to public transport. Changes to by-laws and regulations governing land development should be contemplated by all municipalities as part of their integrated development plans.

Figure 5.2.11 shows some typical land-use proposals which would be supportive of public transport. At the centre of the public transport catchments are cross-roads on the public transport network. These roads may be mixed-traffic minor arterials and/or collector roads linked to the arterial road system. They are focused on accessible activity nodes at the centre of the neighbourhoods, based on a 400 m walking distance for residents. The activity nodes will largely attract neighbourhood retail and community facilities but will also be the location of bus stops. The figure also shows that, particularly on the most significant public transport route leading to the proposed future central business district, mixed high-density land uses may be planned to support public transport, and in some circumstances, trading activity may be encouraged. The figure shows how the feeder routes converge on the major nodes. The central node should combine central place activity, retail, office and service functions, as well as a modal interchange. It is evident that the central area should be highly accessible by road-based public transport.

It should be noted that the street network within the major public transport corridor is an existing street network, which may be incompatible with the principles being propounded in this guideline. It is inevitable that, as major public transport corridors evolve in urban areas, there may be a need for redevelopment to encourage higher intensity land uses in support of the activity in the corridor. Activity nodes are likely to develop at accessible points in the corridor, as indicated in the figure.

Factors contributing to viable and sustainable public transport

There has been extensive research to demonstrate that the features of public transport-friendly urban design include development density, the land-use mix, the configuration of the urban road network and the design of movement or circulation systems which accommodate both pedestrians and public transport vehicles. Throughout this guide reference has been made to settlement planners, but it is increasingly realised that urban settlements should be the product of multi-disciplinary work involving landscape architects, architects, urban planners and designers as well as traffic and transport engineers. Greater effort is required to design streets from a holistic perspective, as advocated in this guideline, taking account of all forms of movement, including bicycles, pedestrians, cars, and public transport.

It is important to remember that the use of public transport involves pedestrian movements at either end of the public transport trip. An unpleasant pedestrian experience will inhibit growth in public transport patronage. Accordingly, very important factors in promoting public transport are perceived proximity to the boarding point of public transport, walking distance to the final destination, the overall street and site designs, pedestrian facilities, and amenities on the sidewalks.

Development density

The two aspects of settlement density which are important to public transport are the location of dense or less dense settlements, relative to public transport services, and continuous density along a public transport route.

In general, as residential and employment densities increase, so do the number of passengers per kilometre along the route also increase, justifying more frequent or higher levels of public transport service. This helps to make public transport much more attractive.

At metropolitan or city-wide scale, it is important that settlements should be continuous; that is, they should not be permitted to “leap-frog” agricultural land or parkland, as was formerly the case with the lower-income dormitory settlements in South Africa. Municipalities affected by discontinuous developments will experience higher costs per capita for infrastructure such as roads and sewers. This will also apply to public transport services. In settlement planning, the costs of new public

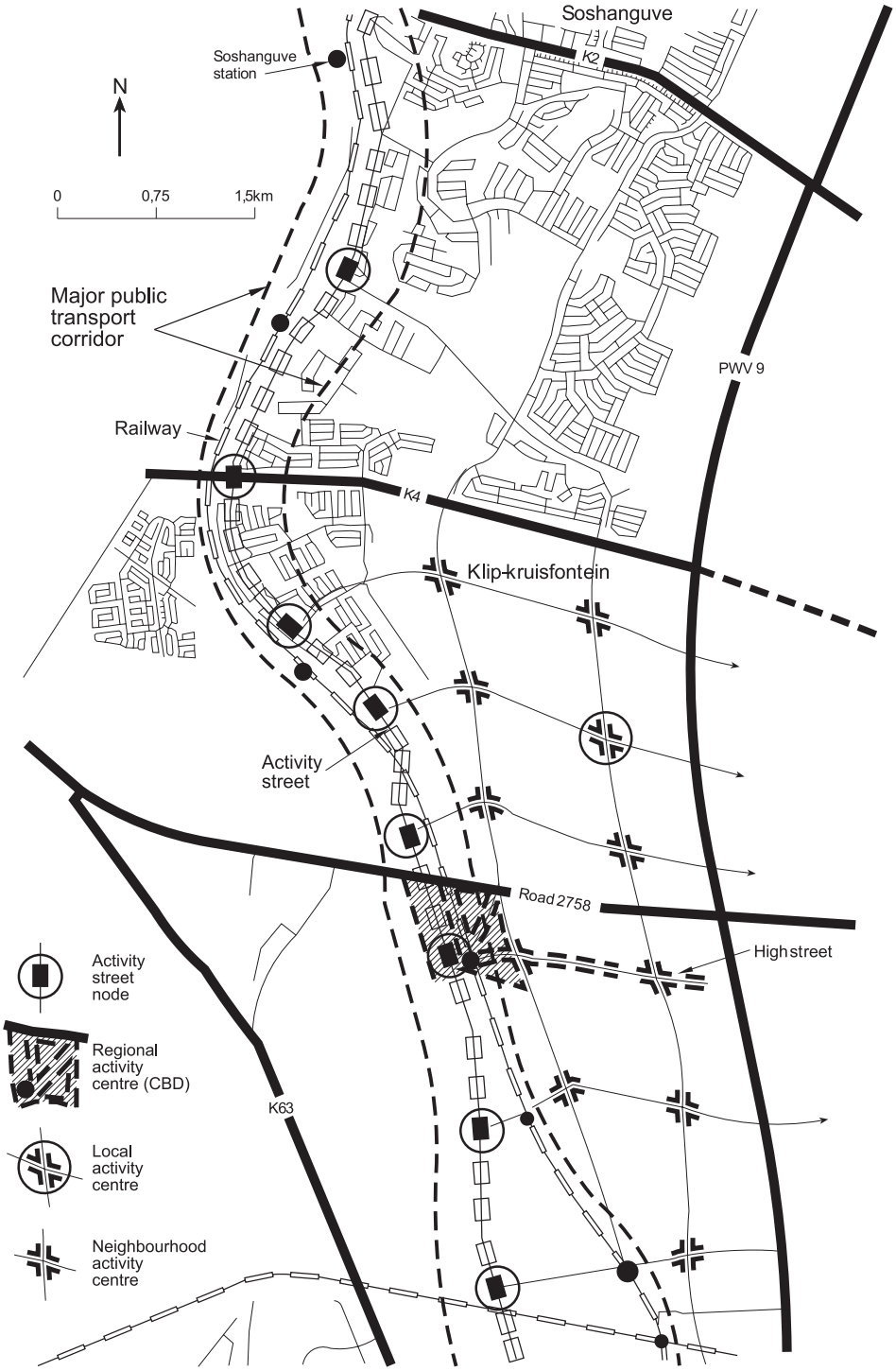


Figure 5.2.11: Land-use elements in relation to the transport framework

transport services should also be factored into the assessment of the municipal infrastructure required for the settlement.

Relationship between density and the location of employment

Future settlement planning should take cognisance of the need to develop balanced communities containing employment activities within the community. The settlement should seek to cluster businesses and employment activities into a few areas of significant development, to help create the critical mass which public transport requires to serve areas cost-effectively. Scattered travel patterns should be avoided so that public transport reflects movement towards a single centre. Empirical research has found that public transport ridership increases markedly when a threshold of one employer per 100 m^2, in a centre with more than 10 000 jobs, is attained. Public transport is therefore heavily influenced by the critical mass of employees, but also by the availability of free parking. Where parking is restricted, public

transport ridership is also enhanced. One of the most serious impediments to the use of public transport in urban areas is the decentralised suburban "business park". Settlement planners must be cognisant of the detrimental effects of such land uses on public transport, and ensure that employment is centred within public transport corridors.

There are two factors that discourage the use of public transport in office or business parks; namely, there is little incentive for employees to consider using public transport when there is free parking, and office parks are usually located some distance from existing public transport services.

Relationship between public transport and residential density

For public transport to be feasible a minimum threshold population is necessary. However, because of the variety of residential market segments in South Africa and the relationship between residential and employment activities, it has not been easy to establish minimum thresholds for residential density. In lieu of clear thresholds and guidelines it is advisable for settlement planners to take note of relationships established abroad. For example, Table 5.2.1 shows public transport services related to residential density as a result of empirical studies in North America. According to Pushkarev and Zupan (1997) the desired threshold for dwelling densities per hectare is around 10 for hourly local bus services, rising to around 40 dwellings per hectare for very frequent public transport services at intervals of less than 10 minutes.

Mixed land use and public transport

Mixing land uses means combining commercial and other uses of various types - for example permitting personal services and restaurants to be located near industry or commerce. Residential settlements should include convenient services within walking distance. The opportunity to walk to and from bus stops and accomplish errands conveniently is a further motivation to use public transport rather than to drive. The central or focal points within any neighbourhood which form part of a settlement should comprise the non-residential land uses such as convenience stores, retail shops, parks, schools and other amenities. The mix of land uses in close proximity to a neighbourhood centre will enable people to accomplish several trip purposes, often by walking. Current zoning often requires strict land-use segregation, resulting in large distances between different activities, increasing single-purpose trips. This can be discouraged by settlement planners who provide conditions conductive to the use of public transport.

Providing for buses, minibuses and bus stops

Alignment of public transport routes

Public transport routes should be planned to follow a reasonably fast and direct itinerary passing as close as possible to the centres of neighbourhoods served by the route. Circular routes should be avoided. Streets used as bus/minibus routes should have a maximum gradient of 1 in 15 (6,7%). Where warranted by demand for public transport, parallel bus routes outside town centres should not be less than about 800 m apart, in order to provide each route with a reasonable catchment area.

Planning to facilitate bus services in new settlements

Settlement planners should take into consideration the fact that areas of intense

Table 5.2.1: The relationship between public transport services and residential density

TYPE OF PUBLIC TRANSPORT SERVICE	GROSS RESIDENTIAL DENSITY (DWELLINGS/ha)
Frequent Service (5-10 minute service intervals)	37
Frequent bus service with some express routes (15 minute intervals)	22
Local bus (daytime 30 minute intervals and extended services at 60 minute intervals)	17
Local bus (daytime 60 minutes intervals)	10

Source: Pushkarev and Zupan (1977)

pedestrian activity such as health clinics, old age homes, schools and bus centres are best located with ready access to the public transport services. As noted elsewhere in this guide, the walking distance to the nearest bus stop should not be more than 400 m from the furthest house. High-density housing developments should be situated closer to the roads along which buses will operate. Development to a depth of at least 200 m on both sides of bus routes is desirable.

Settlement planners should ensure that proper facilities for buses and minibuses are provided from the outset. The following principles need to be borne in mind:

- roads, which may be used as bus or minibus routes, should connect activity centres directly and be suitable as regards width, alignment and construction;
- corner radii should take into account the fact that buses have a large swept turning circle (in the order of 20 to 25 m in diameter);
- bus bays and turning areas should be provided as appropriate (see Figure 5.2.12);
- the minimum width of road for bus operations in new developments should be 7,3 m, or 9 m where there are more than 30 buses per hour using the road; and
- where possible, bus services should have balanced traffic in both directions at peak time. This can be achieved by having employment areas concentrated at nodes along the main bus corridors.

Figure 5.2.13 shows different road layouts, reflecting the history of planning practice. The grid network found in townships that developed before 1950 provided direct pedestrian access to services, shops and public transport.

Sub-divisions over the last 30 years have tended to focus on the internal neighbourhood structure, with roadways designed to reduce travel speeds and discourage through traffic. This type of layout tended to discourage the use of public transport.

This current guide seeks to provide a compromise or a combination that provides the best of both worlds - namely a movement network that caters for direct pedestrian movement in all directions and a road network which inhibits through traffic. These variations are depicted in Figure 5.2.13.

Factors that encourage pedestrian activity and have a direct impact on the attractiveness of walking to bus stops and waiting for buses include

- barrier-free routes, with crosswalks, overpasses and ramps;

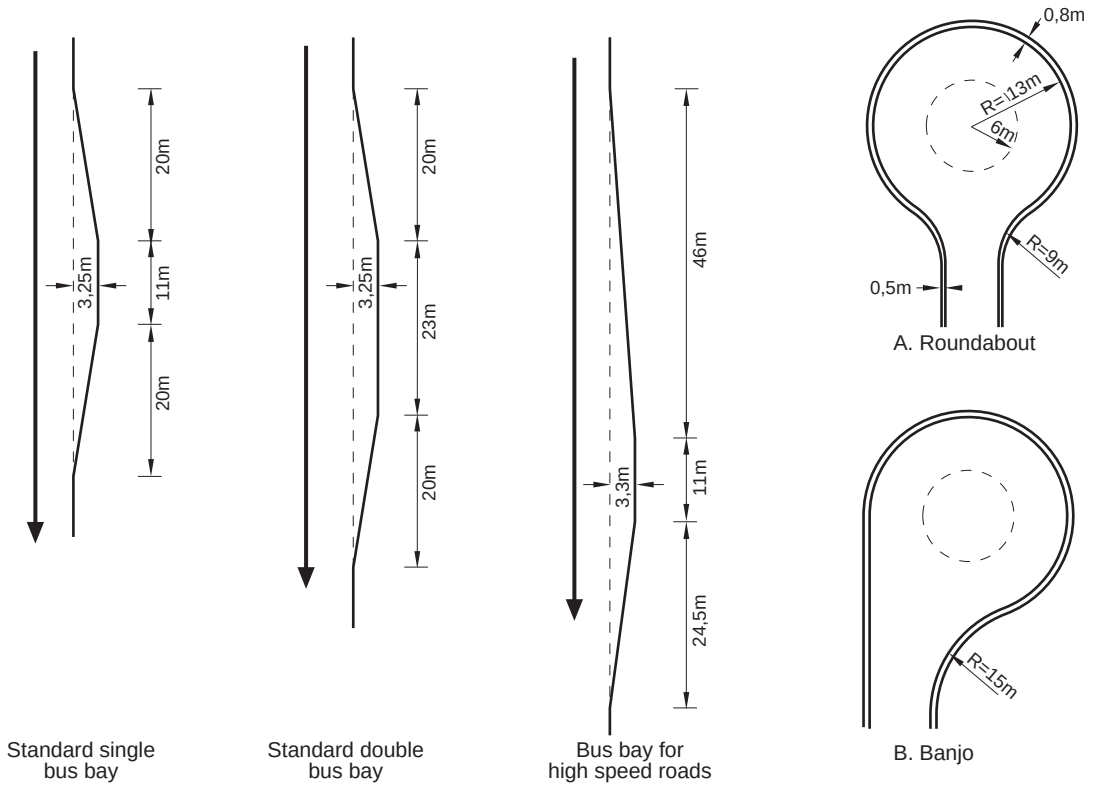


Figure 5.2.12: Dimensions of bus bays and bus turning circles
Source: Greater Glasgow PTE (1973)

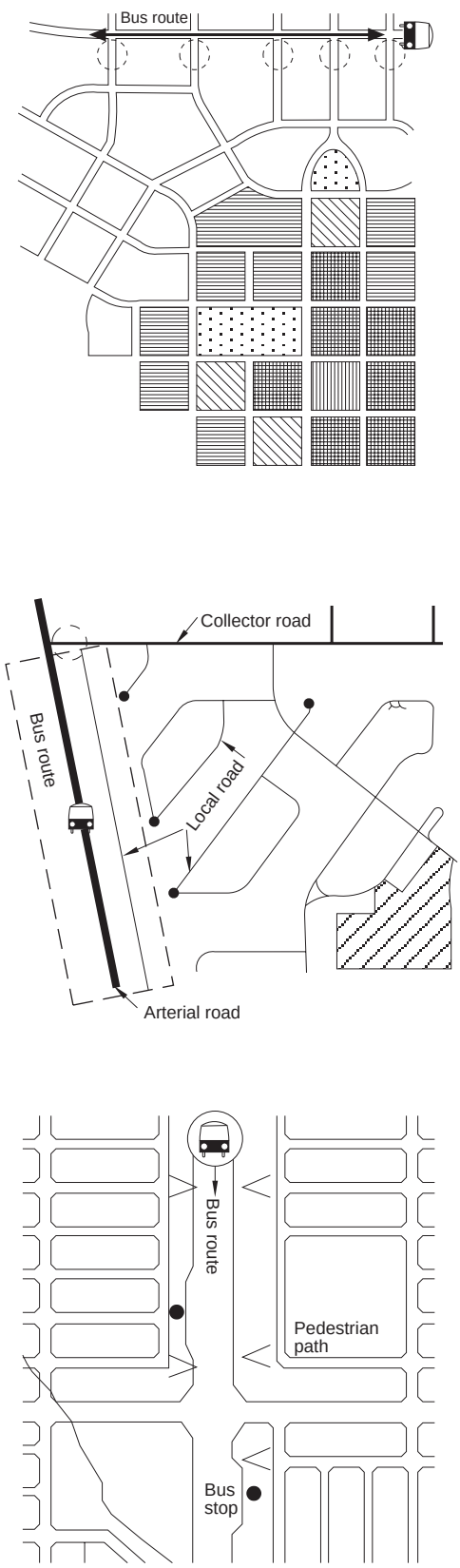


Figure 5.2.13: Road layouts reflecting evolving planning practice
Source: BC Transit (1995)

- good lighting and an environment which is perceived to be safe, because it is overlooked by human activity;
- sidewalks, seating and shelters; and
- pleasant views and other attractions, including landscaping and plantings.

The convenient location of bus stops is significant, and they should be placed relative to building entrances. This aspect is as important to public transport customers as convenient parking is to car users.

Modal choice and relative cost efficiencies for infrastructure and operations

Although this subject is beyond the scope of settlement planners, they should be aware that layout of the movement network and the spatial arrangement of land uses can impact both positively and negatively on public transport. Where modal choice is a consideration, pains should be taken to avoid duplication of public transport infrastructure such as stops and terminals.

The relationship between public transport and commercial sites

Commercial sites in settlements which are supportive of public transport usually face the street and provide easy access for customers approaching by foot rather than by car.

Design features which encourage pedestrian flow include continuous sidewalks, trees and benches, and street furniture that provides a buffer between circulating traffic and the sidewalk. Figure 5.2.14 shows the ideal relationship between a commercial activity site and public transport.

Bus stops

The information that follows applies to both buses and minibuses. The location of bus stops must be planned as part of the movement network at the outset, to achieve the best arrangement. The spacing of bus stops needs to be a compromise between the achievement of as high an operating speed for buses as possible and the placement of stops within an acceptable walking distance of traffic generators, attractors and transfer points. Bus-stop spacing depends on the density of roadside development. Where development is not intense, such as in residential suburbs, stops should be around 800 m apart. In nodal activity centres where there is a high concentration of trip ends, stops should be closer together, with an average separation of around 300 m. If there is more than

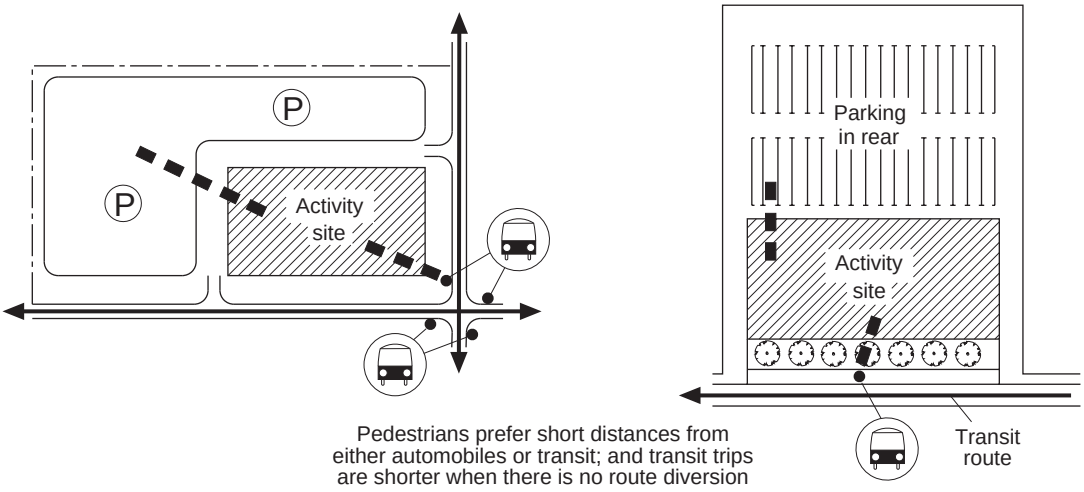


Figure 5.2.14: Relationship between bus stops and a commercial site
Source: BC Transit (1995)

one bus service along a road, transfer is facilitated if all the services use the same stop, providing congestion is avoided.

Bus stops close to railway stations should be arranged to provide the minimum walking distance for transferring passengers. At business centres stops should be sited so that buses deposit passengers at the main frontage of the centres.

For reasons of road safety, bus stops on opposite sides of a single two-way carriageway should be staggered by a least 45 m, so that buses stop tail-to-tail. This dimension may be reduced where lay-bys are provided.

For the convenience of passengers, stops near intersections or junctions should be located as close as possible to the junction consistent with safety. Generally, bus stops should be located at the far side of the junction to minimise interference with left-turning traffic and to maintain traffic-signal efficiency. If public transport is to be promoted, facilities should be provided at bus stops. These include shelters. In siting shelters, care must be taken to maintain adequate sight distance for drivers emerging from side roads. Recommended minimum distances are as follows:

SPEED LIMIT (km/h)	MINIMUM DISTANCE AFTER LEFT TURN (m)
50	23
65	31
80	38

CONCLUSION

If settlement planners are to succeed in providing an environment which is conductive to the use of public transport, the greatest attention to detail should be provided in respect of the development itself and its relationship with surrounding areas. The greatest attention should be provided for pedestrian amenity. Site design features that make public transport more attractive are required but, given the pressures on the road system, it is time to de-emphasise land-use design for the convenience of car users, and refocus towards pedestrian movement and public transport. Public transport-friendly designs can be achieved without detrimental results for car users.

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APPENDIX A

PUBLIC TRANSPORT CATCHMENTS AS THE BASIS FOR NEIGHBOURHOOD PLANNING
Source: Western Australian Planning Commission (1997)

Walkable catchments, when depicted on maps, show the actual area within a five minute walking distance from any centre or bus stop, or ten minutes from any major transport interchange, such as a railway station. The centre should ideally be an activity node for either a neighbourhood or a local community served by public transport. The walkable catchment helps in planning a settlement in such a way that it is easy to evaluate the ability to move through the urban area to access centres.

Walkable catchment calculations are expressed as the actual area within five minutes walking distance, as a percentage of the theoretical area within a five minute walking distance. The theoretical five minute walking distance is shown as a circle with a radius of about 400 metres around a focal points, such as a crossroad. This provides an area of 50 hectares. When calculating a ten minute walking distance, the radius used is about 800 metres, resulting in a circle with an area of 200 hectares (see diagram below). The higher the percentage of actual to theoretical five minute or ten minute walk, the better the "walkability". A good target for a walkable catchment is to have 60 per cent of the area within the stipulated walking distance.

Process for calculating walkable catchments.

1. On the settlement site map draw circles of 400 metre radius around desired focal points, and 800 metre radius circles around rail stations which are either existing or planned.

2. Starting from the centre, measure along the centre line of all planned streets to a distance of 400 metres.

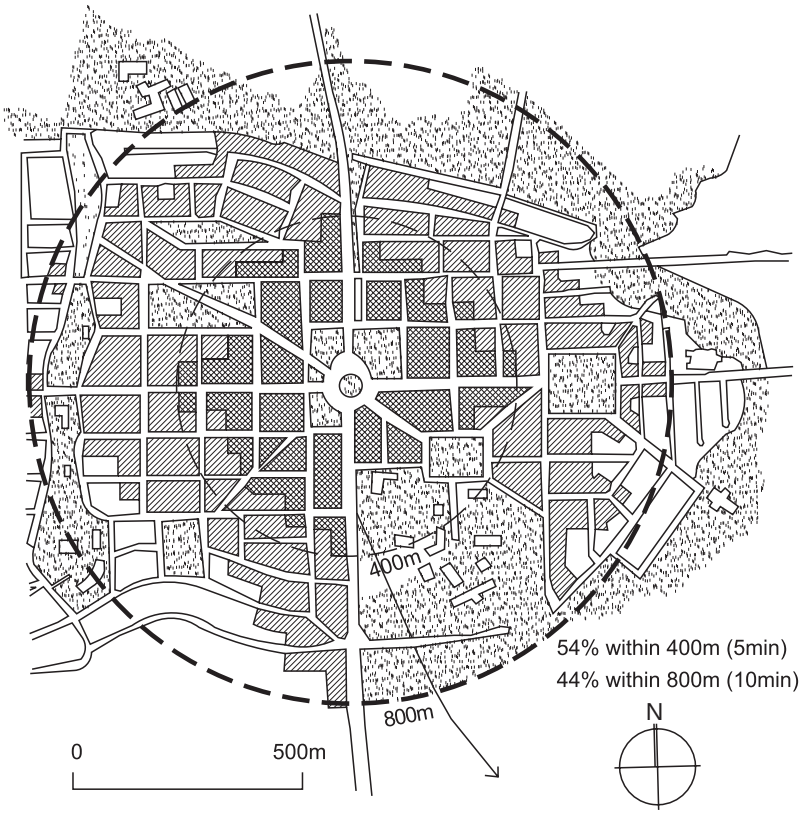
3. Estimate the boundary of the plots within a 400 metre walk. This will provide the actual area from which the centre can be accessed along the planned streets within a five minutes walk.

4. In the case of stations the same exercise may be completed for a ten minute walking distance using 800 metres as the distance measure. On each circle the result will be a map showing the actual distance within both the five minute walk and the ten minute walk from rail stations.

5. Using a grid of scale hectares, calculate the approximate area and hectares and the land accessible within a five or ten minute walk and express this as a percentage of either the 50 or 200 hectare circles. The percentage will indicate the efficiency of the layout.

Note that the walkable catchment should always count the area of land used for dwellings, but not include public open space contained in the accessible area.

It should be noted that in fine-tuning the calculations, there are practical influences, such as short-cuts through parks or along pedestrian paths. These should only be included where there is a high degree of surveillance from adjoining development and where there is good lighting. Similarly, the walkable catchment may need to be reduced where there is poor surveillance and routes may ultimately be perceived as unsafe.



APPENDIX B

GUIDELINES FOR ESTIMATING PUBLIC TRANSPORT DEMAND AND ASSOCIATED PUBLIC TRANSPORT SYSTEMS IN SETTLEMENTS
Source: South Africa, Department of Transport (1998)

The demand for public transport in any settlement is related to car ownership (affected by household incomes), the form of development (density, proximity to services, etc) and the quality of the services. Settlement planners need to understand public transport demand, in order to size facilities appropriately. In short, in planning a settlement, it is necessary to understand whether the public transport component is scaled to mini-bus taxis or buses or trains. The following examples may be helpful. They are based on differing combinations of the 400 metre radius of "walkable" neighbourhoods.

Conditions

1. A "walkable" public transport catchment of 400 m radius, encircling an area of 50 ha.

2. A "walkable" public transport catchment of 800 m radius for rail, encircling an area of 200 ha.

3. In the dwelling density range which is common in South Africa, of between 5 and 30 dwellings per hectare, around 60 per cent of a neighbourhood can be expected to be developed for residences. Thus in a 50 ha neighbourhood the following may be expected:

plot sizes of	200 m^2	=	30 du/ha	=	1 500 units
plot sizes of	600 m^2	=	10 du/ha	=	500 units
plot sizes of	1 000 m^2	=	6 du/ha	=	300 units

4. Plot sizes usually approximate car ownership and household income, with the smaller plot sizes being associated with lower income and car ownership.

Assumptions

The following assumptions may be applied to public transport demand estimation for a low income settlement based on parameters observed in Cape Town in the current "Moving Ahead" transport study:

1. Size of settlement = 50 ha (400 m walking radius).

2. Income of residents = < R40 000/household/year.

3. Non-residential development
   = 2 ha office/retail
   = 4 ha industrial
   = 4 ha schools and parks
   = 10 ha roads and public spaces.

4. Residential modal split = 85 per cent public transport.

5. Office and retail modal split = 60 per cent public transport.

6. Work trip generation rates for households earning < R40 000 per annum = 1,6 trips to work/day.

7. Average trip length = 14 km/trip.

8. Directional split = 70 per cent from neighbourhood to city centre; 30 per cent from neighbourhood to outer node.

Calculations

Public transport trip productions for a settlement of 30 du/ha (gross):

1. Total number of households = 10 000 m^2 /ha x 0,6 = 1 500 du (200 m^2 stands).

2. Commuter trip generation (TOTAL)
   Residential generation = 1,6 x 1 500 = 2 400
   Office/retail attraction = 2,0 x 250 = 500
   Industrial attraction = 4,0 x 100 = 400 .

3. Commuter trip generation (PUBLIC TRANSPORT)
   Residential generation = 2 400 x 0,85 = 2 040
   Non-residential = 900 x 0,6 = 540.

4. Total trips to work = 2 580.

Deductions

1. In the above example the demand for movement out of the settlement in peak work commuter periods amounts to around 1 500 to 1 700 passenger trips (2 040 trips generated, with some having local and others external destinations). There are 540 total neighbourhood trip attractions).

2. Around 1 600 peak period (x 3 hour) commuter trips would approximate a maximum peak hour demand of about 1000 trips per hour.

3. With a road-based public transport supply policy of 5 minute intervals for bus services in the peak, this would translate to a demand of about 12 buses per hour.

4. In a transport corridor comprising five such neighbourhoods on a single route, the capacity to meet such demand (5 000 passenger trips) would amount to 50 buses per hour.

5. In such conditions, a transport authority would need to consider higher capacity public transport options, each of which would impact on traffic movement in the corridor. Such options might include:

   - articulated buses;
   - bus priority and traffic management schemes; and
   - alternative transport nodes modes such as light or heavy rail.

6. In the foregoing circumstances the transport planning authority should be involved in planning the settlement to ensure that conditions on the ground facilitate effective public transport.

7. The above example represents an extreme case of a neighbourhood where residents would be heavily dependent upon public transport.

Forecast

It is not advisable for settlement planners to make long-term forecasts of demand for public transport. As a cross-check, however, the calculations outlined in this Appendix can be used as a consistency check to determine when critical thresholds are likely to be reached in respect of public transport. At that stage, the necessary infrastructure adjustments can be made.

APPENDIX C

THE MOVING SOUTH AFRICA (MSA) STRATEGY WITH REFERENCE TO LAND USE AND LAND MANAGEMENT ISSUES
Source: South African, Department of Transport (1998)

Urban transport focuses on three categories of strategic action:

The first action is the densification of transport corridors. This requires the substantial reversal of apartheid land use planning to halt dispersion, but it is essential to achieve needed economies of scale in the transport system. The strategy will need an aggressive mix of controls and incentives, and will require appropriately integrated coordination of the many institutions with a stake in the urban arena.

Land use patterns are the single greatest driver of the poor performance of the urban transport system in meeting customer needs, and so any solution will require either altering land tenure or working within its existing context. Distance, density, and employment location are all facets of land use that affect the layout of South African cities and, subsequently, the economics and service levels of public transport.

Corridorisation lowers overall system costs - not only for transport but for other infrastructure, too - and also enables lower subsidies, raises travel speeds, and improves frequencies.

Today there is still a tendency towards continuing decentralisation, especially of workplace locations, which further complicates the task of creating compact cities. Some degree of compact city may be achievable in some areas of some cities, and the MSA strategy does not rule out the option in some circumstances. However, the predominant pattern should be the corridor city. The corridor approach fits more easily with the existing South African urban land tenure patterns. Its appropriateness is driven not only by the decentralised distant townships and the low density inner-ring suburbs, but also by a recognition of the decline in CBD vitality and the dispersion of development to satellite nodes. This pattern recognises the existing vacant land occupying the space between most townships and suburban areas, and also builds on existing flows along major current corridors.

Corridors already exist to some extent in South African cities. Therefore, the strategy focuses on densification of existing corridors and creation of new corridors for major new developments. It is essential to prevent the further dispersion of development, and to create incentives for any decentralisation away from the CBD to occur within the corridor context. The major trade-off against the corridor densification strategy is the higher cost of land for new housing projects closer to the CBD. Analysis shows that transport and other utilities generate savings over time which compensate for the increased cost of land.

Housing targets are driving the need to build on cheap, available land, which is causing dispersion. Transport and other utilities have to be provided to serve these dispersed housing developments, bearing increased long-term costs.

Because of the uniquely local nature of land use decisions, the most challenging part of implementing the corridor vision will be the co-ordination across and within government to overcome the obstacles. Some national policies, as in housing, encourage continued dispersion, based on the economics of land acquisition. These policies will need to be harmonised to fit into a paradigm that encompasses the systems cost of all community infrastructure, not just one component like housing or electricity.

The MSA strategy recognises many other obstacles exist to corridor densification, and overcoming these potential pitfalls will require strong co-operation across government. In particular four different public entities will need to act in close co-operation and co-ordination:

- National Government must provide the overall strategic vision for urban development, including transport. It must also create a framework for absorbing systems costs and aligning the incentives for different national departments to follow the framework. Out of this activity will come guidelines for internalising systems costs within land developments.

- Provincial Government must create broad provincial land use strategies that account for full systems cost, within the context of the national government framework. In addition, they will need to orient the subsidy policy to support the corridors, and are responsible for urban roads.

- The Roads Agency will need to align investments in national roads in urban areas with the local corridor strategies developed by local entities.

- Local Government and Metropolitan Transport Authorities will be responsible for developing land use and transport plans, and will now need to be integrated into planning for major commercial and residential developments. The subsidy allocation procedure must be linked into the corridor densification strategy.

The second action works to optimise modal economics and the service mix. Investment in corridors is primarily roads-based, because densities of new corridors are unlikely to support new rail lines. The strategy is one of regulated competition, with integration of modes facilitated. Optimising modal economics requires addressing the use of road space, and the strategy proposes tough road space management to prioritise public transport. A principal lever of the recommended strategy is that of subsidies, which will be targeted and providing affordable access to the stranded and subsidising the most economic mode on each corridor.

The third strategic action entails improving firm-level performance, a task which predominantly falls to private firms. The strategy requires effective regulation of all modes, especially minibus-taxis and the enforcement thereof. It emphasises tendering for subsidised routes and other forms of contract management, with built-in incentives for productivity innovation and reinvestment.

Implementing the strategy will require overcoming some significant obstacles. Changing the nature of land-use planning, road space management, planning and regulation, and subsidy targeting will need agreement on the objectives and strong political will.