PROVINCIAL ADMINISTRATION WESTERN CAPE

DEPARTMENT OF ECONOMIC AFFAIRS,
AGRICULTURE & TOURISM:
TRANSPORT BRANCH

ROAD ACCESS GUIDELINES

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First Edition (Final Draft) and Print – November 1996
Second Edition and Print – May 2001
Second Edition and Second Print – September 2002

PREFACE

This document has been prepared by the Department of Economic Affairs, Agriculture and Tourism: Transport Branch of the Provincial Administration of the Western Cape as a guideline to assist practising engineers and planners, and property developers, in arriving at acceptable road access standards. The content is based on South African experiences and research both locally and abroad. The document is published and circulated for use with the endorsement of the Provincial Minister for Transport, Mr Piet Meyer.

SYNOPSIS

The development of the Road Access Guidelines by the Transport Branch has been driven by the need to define the approach adopted when considering property access applications. The document introduces a unique approach in attempting to find a balance between the demand for an access, with the need to protect the rights of the wider community for sustainable transportation, more particularly, road infrastructure development; while at the same time ensuring adequate mobility in support of accessibility to economic opportunities.

That which distinguishes these guidelines from most others, is that it uses a simplified categorisation approach when defining the *road*, the *development environment* and the desired *access*, and uses selected criteria to facilitate the decision-making process.

The development of the Guidelines has been a fairly protracted process and includes the use of the techniques by practitioners and authorities over a three-year trial period.

FOREWORD

While the need for integration between land use and transport planning has long been recognised, it has often proved difficult to achieve in practice. The subtle balance between facilitating development, while ensuring adequate accessibility and mobility has proved illusive, particularly in urban areas where land costs are high.

As development has escalated and land supply diminished the land use / transportation issues have intensified. Consequently the Transport Branch commissioned consultants to review a range of road access procedures and standards with the aim of producing road access guidelines that would reconcile past difficulties.

It was intended that the process be transparent and consultative; indeed the first task undertaken by the consultants was to identify key interested parties and seek their views, not only on the content of the study, but also in identifying other parties that should be consulted. A consultative panel was also formed to guide the work, and comprised representatives from the Transport Branch and the Provincial Planning Department, together with Cape Town's Metropolitan Transport Planning Branch. More than 50 planning authorities, both nationally and internationally, were consulted for detailed inputs to the Study and a representative sample of local interested parties was interviewed.

A final draft document was produced in November 1996, which was distributed for use and comment by practitioners. It was emphasised that the content of the document in its draft form did not represent the official policy of the Transport Branch.

More than 170 documents were circulated to practitioners and interested authorities. Papers on the subject were presented at the 1997 Annual Transport Conference (Pretoria) and the Road Access Symposium held in Midrand in February 1999. Numerous verbal and written comments were received.

The principles developed in the early stages have been found acceptable in practice as providing a basis to guide decision-making with respect to access provision, and the formulation of arterial (access) management plans.

As a consequence of the many inputs received, and the increased level of understanding of road access management issues, the decision was taken to proceed with the drafting of the Guidelines in the present format.

It is important to recognise that these Guidelines should be used in the development of urban and rural spatial development frameworks, structure plans and arterial access management plans. It is neither the intention, nor considered desirable, that the Guidelines be used in support of isolated ad-hoc access applications. Attention should rather be directed to the overall plans in place, and such policies contained therein, and that these plans be periodically reviewed and adjusted to meet changing demands. These Guidelines should not take precedence over the polices contained in such approved plans.

R F PETERSEN Pr Eng
Deputy Director-General: Transport

Date: 2002-09-25

ACKNOWLEDGEMENTS

The authors of this report extend their sincere appreciation to organisations and individuals who have contributed in various ways to its contents. In particular, reference is made to:

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AMENDMENT CONTROL SHEET

Part/ Section	Title (Description of change)	Detail of Page	Date of Issue
1.8	Traffic Impact Studies (Revision of text below Table 1.8)	6	September 2002
8.5	Petrol Service Stations and DASC's (Revision of third and fourth paragraphs under the heading)	80	September 2002

TABLE OF CONTENTS

CHAPTER 1

CHAPTER 1: INTRODUCTION, OBJECTIVES, PURPOSE AND USE OF DOCUMENT

1.1 GENERAL

The guidelines have been prepared in response to a perceived need for increased flexibility and consistency in the setting of access standards and policy. Initially this was confined to roads under the direct or indirect control of the Provincial Administration of the Western Cape: Transport Branch.

The guidelines as herein presented were devised after considerable consultation with a wide range of Stakeholders in the Western Cape. Reference was also made to road authorities elsewhere, including outside South Africa. An earlier draft version was widely circulated with numerous comments returned. As additional input, the South African Institute of Civil Engineers and Institute for Transport Engineers jointly arranged a '*Symposium on Access Management*' during February 1999, which has added value to the earlier work.

It is anticipated that the users of the guidelines will find that when an application for access conforms to the normal standards or an approved access management plan, the application will meet with no principle objections to its approval. Where the application does not conform, the contents of the guidelines should facilitate the formulation of appropriately motivated submissions, which should facilitate decision-making by the responsible Authority.

1.2 HISTORIC PERSPECTIVE

The existence of a public road is in one form or another linked to legal definition. The national roads, under control of the National Department of Transport, were defined in terms of the National Road Act, now South African National Road Agency Limited Act. Other rural roads are designated as Trunk, Main, Divisional and Minor roads in terms of the Road Ordinance, Ordinance 19 of 1976, with the Province as road authority, and with the District Councils as agents on all but Trunk roads.

Within urban areas national and trunk roads do occasionally exist, however, the majority of main roads have been declared such in terms of the Road Ordinance at the request of the Municipality concerned in order that consistent standards can be maintained and that the financial burden resulting from through traffic movement can be shared.

Policies pertaining to access standards have been influenced by the rural situation where higher operating speeds are evident. Hence, the 500m spacing in the Cape (650m in the former Transvaal), provided that adequate sight distance was available, formed a basic standard, which was often transposed into the urban situation.

Much of the decision-making was influenced by road development philosophy of the USA with its emphasis on mobility and the use of the private car. In turn, this was translated into land use controls, e.g. the Ribbon Development Act 1940 (Act 21 of 1940). With the exception of '*A Policy on Public Garages*' (February 1978), there had been little further attention given to the development of access policies applicable to major arterials. The introduction of the so-called Blue Book '*Guidelines for the Provision of Engineering Services in Residential Townships*' (Department of Community Development, 1993) focussed attention on the lower order roads leaving much of the higher order road network issues unchallenged.

During the past decade the subject has received increasing prominence, due to changes in fundamental land management philosophy and perceived benefits to be derived from direct access, thus emphasising the need to review the approach to road access management.

1.3 SPECIFIC CONCERNS

The decision to compile the guidelines arose because of concerns emanating from the development fraternity, including professional practitioners. Stakeholders polled expressed the following specific concerns:

< existing access guidelines are best suited to promoting transport efficiency concerns and do not respond adequately to urban development objectives;

< existing access guidelines are based on technical issues which are not explained. Broader understanding of the underlying technical issues is necessary so that developers, engineers and planners can work together more effectively;

< the existing road hierarchy often promotes township layout designs which inhibit pedestrian and public transport friendly features. Furthermore, the isolation of residential cells inhibits opportunities for communities to engage in economic activities;

< a practical mechanism is needed for managing the transportation and planning objectives for arterials.

This document endeavours to address the above concerns.

1.4 ROAD ACCESS POLICY STATEMENT

The content of this document also endeavours to give expression and support to the intentions of Government as stated in transport policy and action plans.

In giving consideration to direct property access provision, ***priority shall be interpreted as favouring or protecting the needs of the wider community above the needs of the applicant. In reaching a decision cognisance will be given to the content of an arterial management policy incorporated in the Integrated Development Plans, and Integrated Transport Plan.***

1.5 ACCESS OPPORTUNITIES: THE DECISION MODEL

While the complex interrelationship between land use and transport has long been recognised, it is often misunderstood, resulting in incompatibilities. The subtle balance between facilitating development, enhancing accessibility to centres of activity and, at the same time, ensuring appropriate vehicle access and mobility has proven illusive particularly in areas where land costs are high. As development demand escalates over time and suitable land supply diminishes, the land use/transportation issues intensify.

Central to the process of access provision is the concept of classification. In the model adopted, the type of access desired is considered in the context of the functionality of the road which, in turn, is integral with the wider road environment. The opportunity for access is then evaluated in the context of suitably applied technical criteria together with other nominated considerations. **Figure 1.5** below provides a schematic of this process.

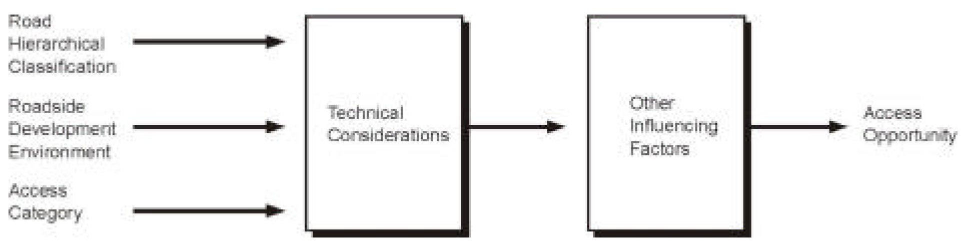


Figure 1.5: The Decision Model

It is important to appreciate that an access, once granted, can only be removed by expropriation with compensation. However, the opportunity to improve or relocate a poor access situation occurs more frequently where

< changes in land use occur (rezonings);
< buildings are recycled; or
< the upgrading or refurbishment of a road takes place.

In all instances the *via necessitas* rule, or right to reasonable access must apply and be respected.

1.6 USE OF THE GUIDELINES

The document has been structured in a manner, which initially establishes the environment within which the road exists and informs on how access decisions should be considered. It is recognised that the guidelines do not cover all situations, in fact, it would be inappropriate to consider all access provision clinically. Important is the need for consensus on the approach adopted.

Chapter 2 - provides an overview of the interaction between land use and transportation-related issues.

Chapter 3 - focuses on spatial planning issues and the defining of ***roadside development environments***.

Chapter 4 - considers the ***road functionality and hierarchical classification***.

Chapter 5 - makes distinctions between interchanges, intersections and property access, and informs on ***access categorisation***.

Chapter 6 - provides technical background and a foundation for decision-making. Included are details of ***normal minimum standards***.

Chapter 7 - considers the management of the road in the interests of future serviceability. This chapter must be read in conjunction with Chapter 8.

Chapter 8 - provides a selection of ***influencing factors*** that may have a direct bearing on the decision to permit an access. The chapter also deals with a number of related issues, which need to be taken into consideration.

1.7 APPLICATION PROCEDURE

Prior to an application for access, the applicant should refer to Section 1.8, ie the requirement for a Traffic Impact Study (TIS).

Within the context of the TIS cognisance must be given to the content of these guidelines and, where applicable, reference must be made to other planning, which may influence or impact on the proposed access situation. The simple adoption of a 'normal access standard' is not acceptable. Recognition of the wider issues debated in Chapter 3 through to Chapter 8 is necessary. All applications for a new or altered access, change in land use or change in road features must be made to the relevant road authority.

Table 1.7: Circulation of Applications
Minimum number of Copies

Road Authority	Regional Manager SANRAL	PAWC: Transport Branch		CMC or District Council	Local Authority
		Head Office	District Roads Engineer		
Metropolitan Area					
National Road	2	1	1	1	1
Trunk or Main Road	-	1	1	1	1
Significant Roads	-	1	1	1	1
Non-Metropolitan Urban					
National Road	2	-	1	-	1
Trunk Road	-	1	1	-	1
Main Road	-	-	1	-	1
Non-Metropolitan Rural					
National Road	2	-	1	1	-
Trunk, Main, Divisional and Minor Road	-	1	1	1	-
All Other Streets	-	-	-	1 or Nil	1 or Nil

1.8 TRAFFIC IMPACT STUDIES

Traffic impact studies are to be undertaken in accordance with the National Department of Transport's '*Manual for Traffic Impact Studies*' PR93/635 (1995).

(Refer Section 29(2) of Act 22 of 2000)

Table 1.8 provides guidance on when a ***traffic impact study*** or ***traffic impact statement*** is required.

Table 1.8: Threshold Value for a Traffic Impact Study

Recommended Threshold	
(i)	More than 150 peak hour single direction trips [a] - prepare a Traffic Impact Study
(ii)	Less than 150 and more than 50 peak hour single direction trips - prepare a Traffic Impact Statement
(iii)	Less than 50 peak hour single direction trips - no study required
(iv)	Discretion of the responsible authority [b]
(a)	*Refers to peak direction "trip-ends" which includes primary and pass-by trips.*
(b)	*Based on the discretion of the responsible local authority, a Traffic Impact Study or Statement may be required eg if the development is located in a sensitive area, even though less than 50 peak hour trips are generated. Alternatively, only a Traffic Impact Statement may be required although the development generates more than 150 trips, but is for example located in an insensitive area.*

All Traffic Impact Studies should be guided by the content of the NDoT document PR93/635 (1995). In addition, the National Land Transport Transition Act (Act 22 of 2000) calls for Transport Impact Studies; while guidelines for these have yet to be outlined, it is necessary that all Traffic Impact Studies report on Public Transport matters and on alignment with the "Public Transport First policy".

It is recommended that a ***Traffic Impact Statement*** includes a brief description of the development in terms of existing and proposed land use and trips generated:

- A brief description of the existing operational conditions of the road network in the immediate vicinity of the development;
- An assessment (non-analytical) of the operation of the access(es) to the development and that of intersections on either side of the access(es) to the development;
- Conceptual geometric layout of the access arrangements; and
- Professional opinion on the expected traffic impact based on a site observation during the expected critical peak hour and the analysis conducted.

All studies should be undertaken by suitably qualified professional transportation/ traffic engineers or technologists.

CHAPTER 2

CHAPTER 2: LAND USE / TRANSPORTATION ISSUES

2.1 GENERAL

This chapter aims to provide an overview of the complex relationship that exists between land use and transportation, and the wider planning and developmental issues that have an important bearing on the selection and management of the road network.

The higher order arterial or principal road network has developed largely as a consequence of increased traffic demand, with the emphasis on maintaining reasonably high operating speeds at high levels of service. This situation is challenged as a consequence of diminishing funds for roads and changes in spatial developmental thinking. Required is that increased attention is given to the optimal utilisation of existing road infrastructure, particularly so within the urban environment and ensuring that roads provided satisfy the wider economic developmental objectives.

2.2 LAND USE / TRANSPORTATION INTERACTION

In effect, two interactive systems are constantly being dealt with and striving to reach economic equilibrium. The first is the **activity system,** which focuses on place and related patterns of interaction, or what people do at such places, be it within residential areas, places of work or areas of leisure time activity, etc (often referred to as precincts or traffic zones). These activities cannot be separated from the other equally important component, the **movement system** or communication system, which supports these activities.

The extent to which the demand for movement is created is largely dependent on the nature of the **activity systems** and the spatial interrelationship between these mutually supportive systems. The **movement system**, on the other hand, facilitates the passage of people, goods and services by way of a variety of modes.

It follows that the relationship between land use activities and the movement system is extremely sensitive to the nature of either component. This aspect is fundamental to the promotion of, or possible inhibiting of movement, and/or the prospect of economic growth activity on the land. In turn, this must be responsive to many other relevant environmental circumstances. **Figure 2.2** has relevance.

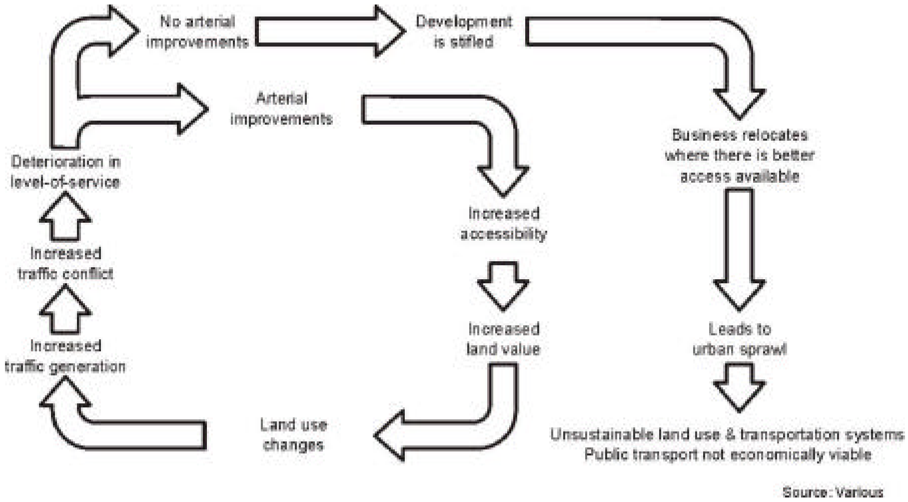


Figure 2.2: Adapted Land Use / Transport Cycle

2.3 ACCESS, ACCESSIBILITY AND MOBILITY

Fundamental to these guidelines is the matter of direct **access** provision to a roadway; this by way of a driveway or street connection. The term 'good access' is often interpreted as referring to the issue of **accessibility** or the ability to reach destinations. **Mobility**, on the other hand, refers to the ability to move to that destination without undue hindrance. '***Accessibility is a function of land use configuration (proximity), transport networks and services (connectivity), and system performance, or quality of movement (mobility***)' (Ref: Moving Ahead, CMC).

The extent to which mobility is desired or satisfied on the transport or movement system, is dependent on a variety of factors relating to the spatial location and interrelationships between the various activity zones at the micro, meso and macro levels, and the provision, appropriateness and effectiveness of the transport system. The transport system is viewed as the network of transport infrastructural elements, and includes rolling stock, vehicles, etc.

Figure 2.3 is often used to illustrate these relationships as applied to roads. With increasing emphasis being placed on the promotion of public transport, accessibility to such a system, particularly by walk mode, becomes a vital consideration. Associated with this is the need for improved levels of mobility for public transport vehicles in relation to that of the private vehicle. This raises the issue of walkable catchments, appropriate bus stop spacings and reduced side friction (minimum roadside parking and driveway access provision).

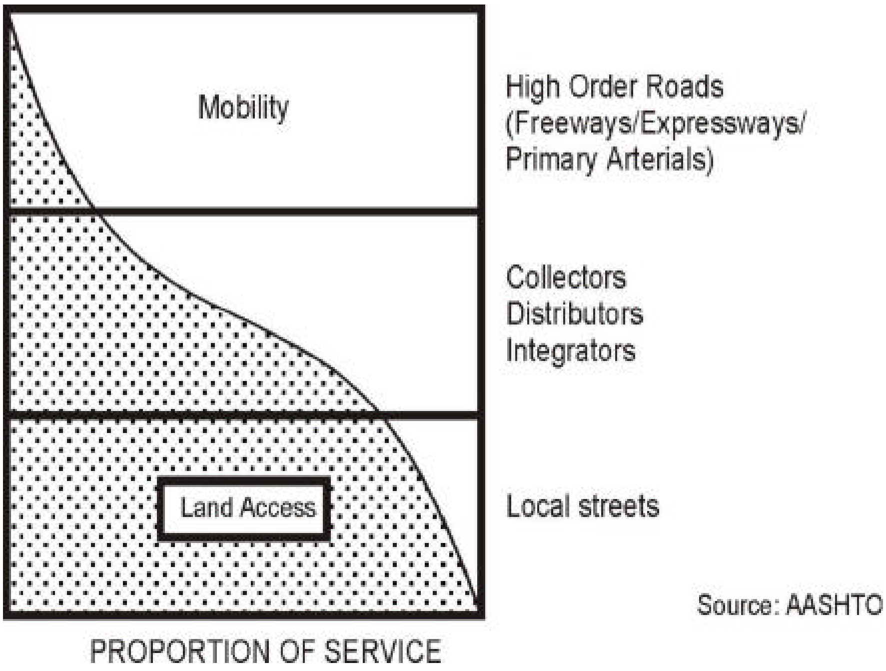


Figure 2.3: Functionality, Mobility and Land Access

2.4 ROAD-BASED TRANSPORT AND ECONOMIC DEVELOPMENT

Studies have shown that roads to an appropriate scale are a prerequisite for all forms of land development and thus economic growth. Whereas all roads play a role in influencing spatial form and economic development, high order arterial roads, in particular, are a significant determinant of the spatial form of towns and cities and have a significant influence on the economic and social efficiencies and effectiveness of towns and cities and of the well-being of their citizens. However -

- high order arterial roads *per se* do not cause changes in urban spatial form or economic development (or its location), rather they permit such changes by their presence and inhibit or prohibit such changes by their absence;
- an arterial road is usually only one of a number of prerequisites for development; good access from a high order road does not necessarily lead to successful development, especially if the road does not join economic activity centres with reason to interact strongly with each other;
- areas are often in competition to attract development; thus an area may have a number of attractive features, including access from an arterial road, but development could go to other areas that are more attractive at that time;

< a frequent sequence of events is that, whereas developments may take place largely because of their access to existing arterial roads, these roads are subsequently upscaled to accommodate the traffic, i.e. the development often drives the upgrading of roads, not the other way;

< the spatial structuring and economic development that arterial road improvements may facilitate will almost certainly impact differentially on different citizens, communities, businesses, etc.

The need for integrated planning of all sectors significant to spatial and economic development (to which must be added social development, services, infrastructure and institutional development, among others) is evident. Not only the planning, but the integrated implementation of these plans is important.

2.5 TRAVEL DEMAND MANAGEMENT (TDM)

TDM is, in effect, a management tool with an associated package of measures aimed at reducing the use of private vehicles in cities. It is inevitable that as cities continue to grow, congestion levels will worsen and impose negative and stressful impacts on community life. While congestion relief measures have their place, experience has shown that congestion will re-occur as the road users take advantage of the opportunities created by the capacity improvements made.

Access Control Policy is one of the package of measures which can contribute to a TDM initiative, as it directly impacts on the way private vehicles are used on the road network. In fact, it can be argued that road access management and TDM working in tandem is the only sensible way of ensuring sustainable quality of life in expanding metropolitan areas.

2.6 PUBLIC TRANSPORT PRIORITY

In recent years increased attention has been given to the provision and management of road-based public transport, currently provided by bus and/or minibus taxi services. The road, and the way it is managed, directly and indirectly impacts on the efficiency and effectiveness of public transport in meeting basic transport needs and the prospect of meaningfully contributing to long-term travel demand management.

It is anticipated that as planning for the transformation of the public transport system accelerates, attention will focus on the priority afforded to bus / minibus taxi operations on the road network. This immediately raises two access-related issues that need consideration in the overall planning and policy setting process:

< how is pedestrian access to the road-based public transport system catered for; and

< to what extent does vehicular access to property impact negatively on public transport operations (and to the safe effective passage of pedestrians and bicyclists)?

These matters are briefly dealt with in **Chapter 8**.

2.7 ROAD SAFETY CONSIDERATIONS

The high accident rate and, in particular, the high incidence of pedestrian accidents is a matter of major concern. The CSIR has indicated that the road environment (geometry) contributes directly to some 14% of all road accidents. Research elsewhere, notably Holland, suggests that the road environment contributes directly and indirectly to 48% of accidents. Research in Australasia has indicated that the greatest exposure to accident risk occurs in the middle order roads (district and local distributor level).

This emphasises the need for a balanced view on the provision of access, both for vehicular traffic and for pedestrians to the road network. In this regard it is important to note the requirements outlined in the COLTO South African Road Safety Manual in the assessment of access provision.

2.8 TRAFFIC FLOW CHARACTERISTICS AND TRAFFIC GROWTH

Traffic Flow Characteristics

Traffic at any point on the principal road network consists of

< long distance intercity traffic;

< medium distance intertown traffic;

< external - internal (or farm to market) traffic;

< intra-urban traffic - urban areas only.

The portion of each varies depending on location on the network, and the extent to which daily, weekly and seasonal variations exist. Seasonal variations are the product of holidays, harvesting and other influences. As the design of roadways needs to take cognisance of these variations, reliance on short term counting and historic data for design purposes must be treated with caution.

Fundamental is the reality that few, if any, roads in both Metropolitan and non-Metropolitan areas serve a single function. All principal roads satisfy a variety of travel needs and travel mix, which relates to location and proximity to centres of economic activity.

Traffic Growth Considerations

In addition to the inaccuracies associated with short duration traffic counting is the uncertainties relating to estimations of future traffic growth. Traffic is a product of land use activities and, as a consequence, traffic growth estimates should consider the effects of different socio-economic variables. More realistic ***growth estimates should be determined from regional, metropolitan or local traffic demand models, or the use of other traffic growth estimating techniques***.

Bester (of VKE) developed such models for rural roads, which take cognisance of population density, gross geographic product, number and growth in economically active population. Two traffic models were developed (one for total and one for heavy vehicle traffic) by means of a stepwise regression analysis. They are as follows:

Total Traffic:

TGR = 8,94 - 1,47 STR - 0,015 AREA + 2,05 EC - 0,215 GEA + 0,0816 STR * GEA

Heavy Vehicle Traffic

TGR = 6,73 - 1,31 STR - 0,017 AREA + 0,049 GGP - 0,178 GEA + 0,0635 STR * GEA

WHERE

TGR	=	Traffic growth rate (% p.a)
STR	=	Stratum (B1 = 1,B2 = 2 ……………………………. D = 5)
AREA	=	Area of region (1000 km²)
EA	=	Economically active population (million)
GEA	=	Growth in EA (% p.a)
GGP	=	Gross geographic product ($R10^9$)

With the increased focus on optimal utilisation of scarce resources and the lack of regional transport models, it is recommended that Bester's methodology be used in non-Metropolitan areas.

2.9 TRAFFIC IMPACT LEVIES

Almost all rezonings and sub-divisions impose additional traffic on the road network due to the intensification of land use. Typically, agricultural land is rezoned to residential or other use, or residential land rezoned to business or commercial use, or sub-divided to accommodate a residential use of greater density. The additional traffic generated will either

< Impose a minimal impact on a road network that operates at an acceptable level of service, in which case no physical alteration is appropriate; or

< Impose a major impact on a road network that previously operated at an acceptable level of service, in which case road improvements would be necessitated; or

< Consume spare capacity on a road facility so that natural traffic growth generates a premature need for upgrading soon after the completion of the development; or

< Cause additional congestion on a road previously operating at an unacceptable level of service.

It is reasoned that a change in land use should not impose unacceptable traffic delays on existing road users or burden the road authority with the cost of street improvements that would not otherwise be required. Furthermore, site generated traffic should not consume such surplus capacity on the street network as to expedite a need for upgrading that natural traffic growth would only require at some future date. In such cases, the developer should contribute to the upgrading of ameliorative traffic measures.

Currently, no mechanism has been established which

< Provides an equitable means of apportioning traffic improvement costs between the (initial) developer and the road authority;

< Ensures that the subsequent developer contributes an equitable sum to the cost of traffic improvements, i.e. where traffic generated by a (second) development

uses upgraded road infrastructure financed by a previous developer of another site or by the road authority;

- Adequately deals with the accumulated effects of a number of rezonings or redevelopments;
- Provides for a contribution towards the promotion of public transport development, or traffic demand management, as an alternate to road space improvements.

As a consequence, road improvements are generally financed by the larger developer and based on that immediately required to meet the changed traffic situation. The alternative is the acceptance of a smaller scale of development or a no-development scenario.

CHAPTER 3

CHAPTER 3: SPATIAL PLANNING AND ROADSIDE DEVELOPMENT ENVIRONMENTS

3.1 GENERAL

Having given attention to some over-arching issues relating to the interaction between land use and transportation and, in particular, to road-based transportation, it is now necessary to focus more specifically on spatial planning issues and how these are dealt with in the context of road access management.

On the one hand, there exists an opportunity to plan holistically. In this regard the focus is on integrated spatial development planning which directly or indirectly includes integrated transport planning. On the other hand, however, a large number of *ad hoc* planning decisions need to be made, often without the benefit of a long-term vision or development strategy having been formulated.

The intention in this chapter is to increase awareness of the road within the context of the surrounding environment, and in the process facilitate future decision-making. An important debate, which relates to the matter of open and closed road networks has relevance here, and is important in the context of the road functionality and classification. Refer also to **Section 4.6** in this regard.

3.2 INTEGRATED DEVELOPMENT PLANNING (IDP)

The integrated development planning process is that process through which a local or provincial planning authority can establish short, medium and long term development and action plans. This is outlined in the Local Government Transition Act 1966 (Act 97 of 1996) and the Development Facilitation Act 1995 (Act 67 of 1995). These laws require that municipalities to

< set development objectives ; and

< carry out an Integrated Development Plan.

The situation is marginally different in KwaZulu-Natal and the Western Cape where other legislation applies. In the latter case, the Land Use Planning Ordinance 1985 (Ordinance 15 of 1985) has relevance, however, this is in the process of being redrafted.

In essence, the aim is to bring together the efforts of the various spheres of Government at Municipal level, together with the efforts of affected community and other stakeholder groups in setting development goals and actions through the appropriate use of resources.

Outputs include a vision for the spatial form of the urban or rural area including an overview of the transportation elements. It is within the context of the IDP that the importance of the higher order roads (and rail systems) needs to be highlighted and understood by participants in the planning process.

Spatial Framework for Development Planning

The trend followed in support of the reconstruction and development principles and in keeping with leading cities elsewhere in the world aims to

- Manage available urban resources in an endeavour to meet long term growth sustainability;
- Contain urban sprawl by limiting the rate of expansion;
- Densify development in the interest of increased accessibility to opportunities and services;
- Integrate development planning, particularly relating to the creation of opportunities and available choice, while minimising the demand for, and cost of movement;
- Redress the inequities created by previous land use decision-making;
- Create urban environments, which provide opportunities for positive personal, social and economic development in an environmentally acceptable manner.

Spatial factors or restructuring elements that have been identified and which form the spatial development framework generally include the potential development of urban nodes, the so-called activity corridors and metropolitan open space systems (MOSS), together with the defining of the urban edge. To this must be added the significant and supportive higher order movement system, be this road- or rail-based.

Within non-Metropolitan areas two spatial development models have relevance. These are referred to as

The European Model - in this model the focus is on decentralised development and support for numerous small towns and villages removed from the major economic centre. This supports a 'beads on a string' development approach;

The Primate Model - In this situation emphasis and support is given to maximising development opportunities in selected major or significant economic centres with minimal consideration of intermediate locations. The assumption being that the greater portion of the population can be better serviced from the scarce resources available within these larger centres.

The ribbon development policy embodied in the Ribbon Development Act 1940 (Act 21 of 1940) lends support to the primate model, which is being challenged in practice.

From a rural road management perspective it is important to note that most non-metropolitan communities are widely dispersed and are of low population numbers and density. Increased non-agricultural activities, e.g. tourism facilities, farm stalls, etc along roads leads to increased vehicular use of accesses, increased pedestrian presence and increased road safety and security risks. In turn, this requires increased investment in safety features and results in a slowing down of through traffic speeds, which can be perceived as having both positive and negative economic consequences. Clearly, there is the need to be mindful of the long-term implications and to put in place accesses policies, which compliment both the land use and transport development objective.

3.3 INTEGRATED TRANSPORT PLANNING (ITP)

Included in the IDP process is that of integrated transport planning which deals more specifically with the movement system. A number of planning guidelines exist and the requirements are framed in the context of the overarching National Land Transport Transition Bill, which will be promulgated at some future date.

The underlying principles for an Integrated Transport Planning (ITP) process include:

- That planning is a continuous process;
- That a balance is required between long term and short term planning;
- That there should be realistic handling of future uncertainties;

< That constructive public participation should be encouraged;
< That there should be integration between transportation and land use; as well as
< Interaction between the various modes of transport.

The main output components are the

< Public Transport Plan (PTP);
< Transport Infrastructure Plan;
< Traffic / Travel (Demand) Management Plan;
< Financial Plan.

The transport authorities will take on increased responsibilities in managing these processes.

3.4 SPATIAL LOCATION OF ARTERIALS

The physical relationship between roads is dependent on a variety of road geometric, operational and accessibility considerations (both vehicular and pedestrian). In general terms, the urban spacing of roads falls within the following:

Freeways	8 - 11 kms
Expressways and Other Primary Arterials	2 - 4 kms
District Distributors	1 - 1,5 kms
Local Distributors	0,5 - 1,0 kms

Figure 3.4 provides a schematic of an urban situation. The location of the lower order roads, i.e. local and district distributors should relate to a 5 minute or 400m walkable distance to gain access to public transport vehicles which should be planned to operate on these roads. In turn, these should link to the higher order roads, which provide increasing levels of mobility.

The extent to which capacity is provided on these roads is a separate debate, as it relates to the degree of mobility, desired or tolerated, in the context of the integrated transport plan. It suffices to state that a basic understanding and acceptance of the spatial relationships is of considerable value in the management of congestion situations, and that of change, e.g. from a rural to an urban state.

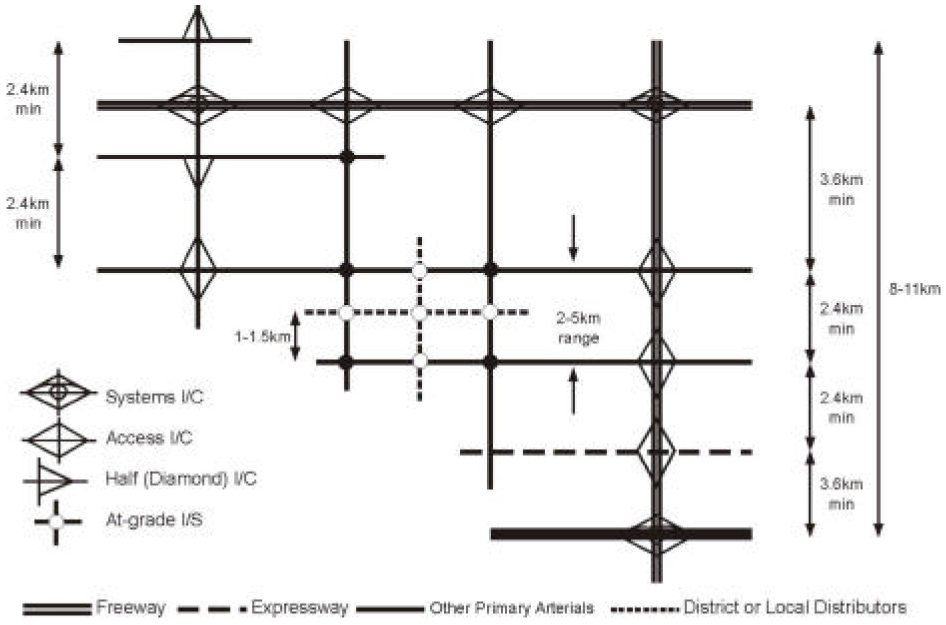


Figure 3.4: Spatial Relationship of Arterials

3.5 DEVELOPMENT CORRIDOR

Within the context of many of the urban spatial development initiatives is the concept of connecting economic activity centres with an activity or development corridor. This corridor generally contains a central activity spine or roadway within a more densely developed environment. The density of development lessens as distance increases from the central spine.

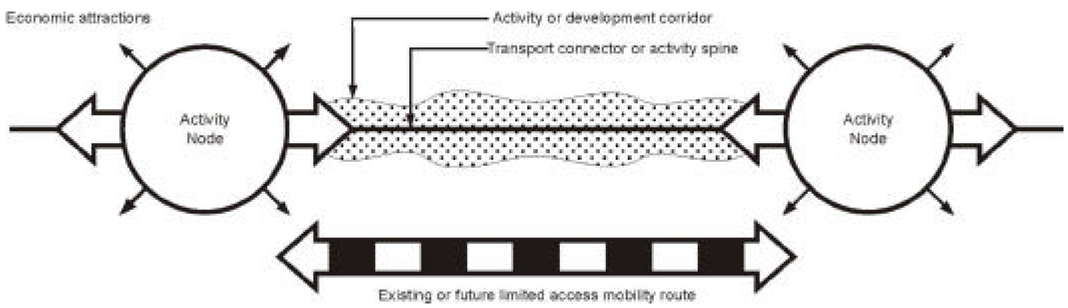


Figure 3.5: Development Corridor

An important feature of the activity spine is that it is intended to facilitate increased exposure to roadside activities and, as a consequence, leads to increased economic activity, together with an overall shortening of travel distance by people, goods and services along its length. The net effect is that of increasing accessibility to opportunities, a reduction of certain mobility functions along the route and a net saving on travel time and costs.

The higher order mobility functions may need to be provided for in close proximity by way of higher order road facilities and/or a mass transit way.

While this concept is being exploited in the Metropolitan areas, its appropriateness in non-Metropolitan regions is also receiving consideration.

3.6 ROADSIDE DEVELOPMENT ENVIRONMENT

The overall transport system should aim to support development objectives while maintaining satisfactory levels of operational and safety service. The urban and rural form, development density and the transport system are interdependent and, consequently, responsive to changes or interventions in any. The objective of mutual support can be furthered by establishing road access control guidelines, which are sympathetic to the various roadside development environments.

Five development environments have been selected to facilitate the decision-making process. These include in descending order of development density, urban, intermediate, suburban, semi-rural and rural environments. The density criteria associated with each is based on the intensity of development, be it farmland, residential, industrial, retail, office or a combination of these.

The depth or bandwidth of the development environment as measured from a particular road relates to that appropriate under the existing or planned density situation, and consists of that area which has influence on the road in question. The intention is that of maintaining access demand at manageable levels.

For the purpose of ***access control on roads that separate two development environments, the default decisions will be based on the less dense development alternative***.

The boundary between an urban and rural area as defined in the Ribbon Development Act 1940 (Act 21 of 1940) will generally fall within the 'semi-rural' development environment. This is illustrated in **Figure 3.6.**

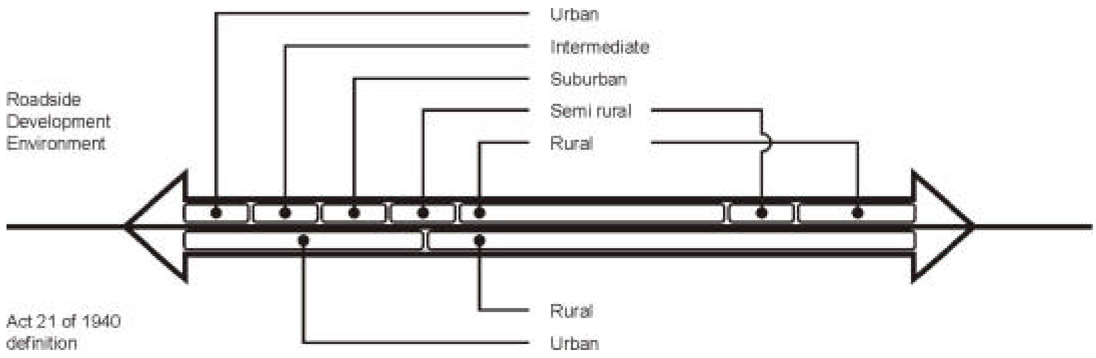


Figure 3.6

3.6.1 The 'Urban' Development Environment

The typical urban roadside environment is dense with commercial / institutional / residential development within activity nodes, e.g. a central business district. Development density will generally be in excess of some 10 000m² GFA per hectare. The road grid pattern is quite fine in order to serve high-level access seeking traffic. Frequent driveway access, on-street parking and high pedestrian activities are typical features along most roads serving this environment. In most cases operating speeds will be in the region of 50 km/hr or less, depending on road type. An illustration of such an environment is given in **Figure 3.6.1**.

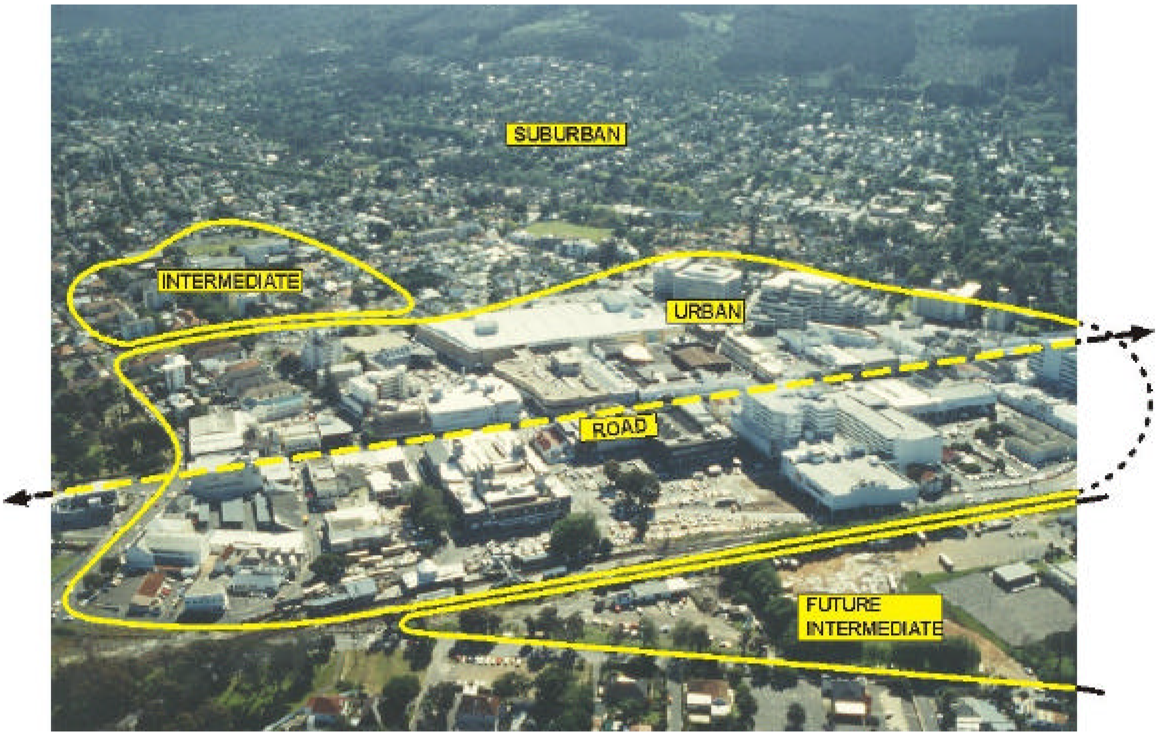


Figure 3.6.1: Urban Development Environment (> 10 000m² GFA/ha)

3.6.2 The 'Intermediate' Development Environment

Typical intermediate roadside development is relatively dense within the range 3 000 to 10 000m² GFA/ha. This may be found within activity nodes (e.g. regional shopping centres, industrial areas, high density residential areas) or along activity spines. Driveway access demands are lower, on-street parking is less pervasive and pedestrian activity is not as great as that in dense urban development environments. The road grid pattern can be coarser than in the urban development environment since access seeking traffic volumes are lower. Refer **Figure 3.6.2** for an illustration.

These features combine to promote less friction between access seeking traffic, and pedestrian on the one hand and through traffic on the other. Higher operating speeds than for the urban environment (50 - 70 km/hr) are typical under these conditions, but dependent on road type and design.

Figure 3.6.2: Intermediate Development Environment (between 3 000 - 10 000m² GFA/ha)

3.6.3 The 'Suburban' Development Environment

The typical suburban development environment has primarily residential land use in the vicinity of the road. Development densities are in the range 1 000 to 3 000m² GFA/ha. The residential areas are usually served by a network of local distributors and access roadways which connect to the higher order district integrators / distributors and principal road network. The subject road could form part of or be adjacent to an isolated residential (or closed network) cell, or be a multi-functional road within an open grid-type network. Operating speeds on the road varies considerably depending on type and design. An illustration of a suburban development environment is presented in **Figure 3.6.3.**

Figure 3.6.3: Suburban Development Environment
(1 000 - 3 000m² GFA/ha)

3.6.4 The 'Semi-Rural' Development Environment

The semi-rural or peri-urban development environment is typically at the edge of an urbanised area. Very little roadside development is present, but may include small holdings and small farms. There may be pressure for the establishment of farm stall-type businesses, roadside services and isolated townships. The likelihood exists that these areas will experience more intensive development within the next 30 years. In these areas there are typically no streetlights or barrier kerbs. Paved sidewalks for pedestrians are rare, although pedestrian activity may be significant. Accesses to roadside properties are typically of the unpaved low volume-type.

Recreational cyclists, farm vehicles, goods vehicles and passenger cars create a wide mix of vehicle types and speeds along these roads. Longer distance traffic dominates on these routes with operating speeds of 70 - 100 km/hr being typical. Refer **Figure 3.6** for an illustration.

In these areas consideration needs to be given to the future form of the transport system and requirements in terms of land take for roads.

Figure 3.6.4: Semi-Rural Development Environment (< 1 000m² GFA/ha)

3.6.5 The ‘Rural’ Development Environment

The rural development environment is typically beyond the likely development fringe of an urbanised area and consists of natural, extensive and intensive agricultural areas. The size of farms is such as to form economically viable units, which collectively make a significant contribution to the regional economy. In these areas there may be small farm stalls or other randomly located tourism-related developments. The roads are typically rural in design, built above the natural ground level to ensure drainage and intended to provide for vehicular movement with low pedestrian presence. Operating speeds vary from 80 - 120 km/hr depending on the road hierarchy and design standards applied.

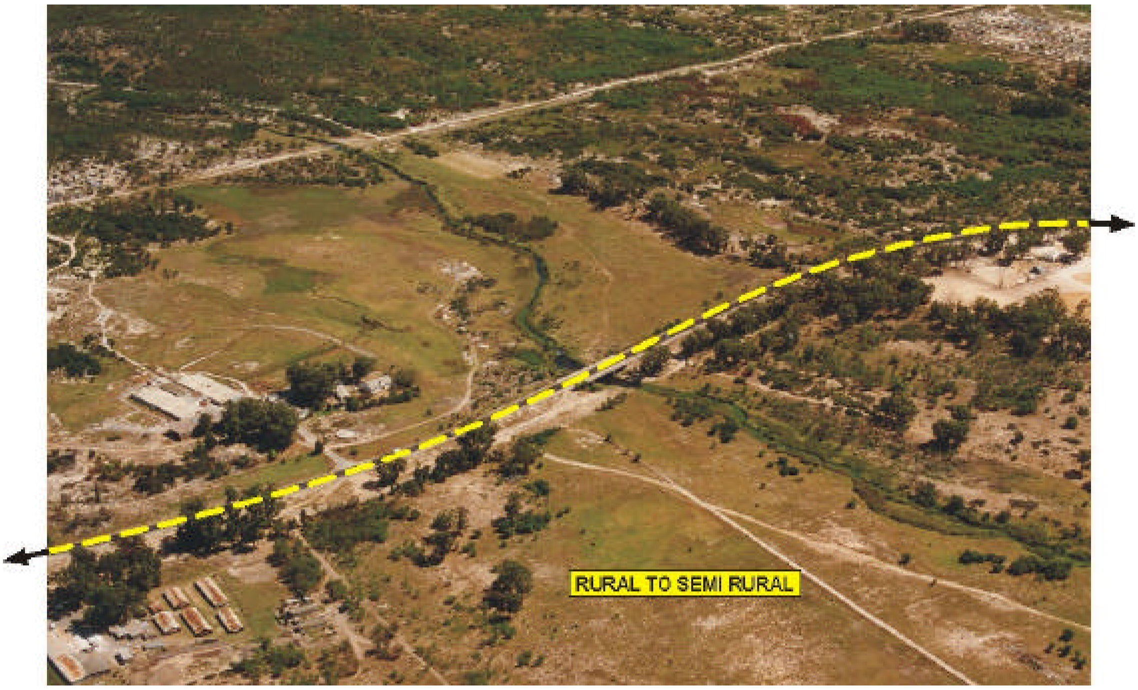


Figure 3.6.5: ‘Rural’ Development Environment

CHAPTER 4

CHAPTER 4: ROAD FUNCTIONALITY AND HIERARCHICAL CLASSIFICATION

4.1 GENERAL

The purpose of this chapter is to provide brief descriptions on the generally used definitions and reasons for adopting a consolidated road hierarchical classification. The following classification has been adopted.

Road Category	Function
Freeway	High order Arterial, Primary/Principal Movement
Expressway	
Primary Arterial	
District Distributor	District Distribution / Integration / Collection
Local Distributor	Local Distribution / Integration / Collection
Access Roads / Streets	Individual property access via access collectors, loops, cul-de-sacs, etc.

4.2 LEGAL DEFINITION OF ROADS

Definitions of roads are provided for in terms of current legislation and are as follows:

National Road - A road proclaimed as a national road in terms of the South African National Roads Agency Limited and National Roads Act No. 77 of 1998. On these roads the road authority is the Department of Transport.

Trunk Roads - A road proclaimed as a trunk road in terms of Provincial Ordinance 19 of 1976. The road authority is the Provincial Administration. Trunk roads have a statutory 30m reserve width, or such other width as directed by circumstances.

Main Road (Rural) - Main roads in rural and semi-rural areas are generally controlled by the Provincial Administration and maintained by the District Councils. Statutory road width is 25m.

Main Road (Urban) - Urban main roads (PMR's) are extensions of rural main or trunk roads in urban areas. The road authority is the local municipality.

Note: Both rural and main roads are proclaimed such in terms of the Roads Ordinance 9 of 1976.

Divisional Roads - Proclaimed in terms of the Roads Ordinance 19 of 1976 with a statutory width of 20m. These roads are found in rural areas. The Provincial Administration is the road authority, with the District Council maintaining the roads on an agency basis.

Minor Roads - These are rural access roads proclaimed in terms of the Roads Ordinance 19 of 1976. The statutory width is 20m and roads are maintained by the District Council.

Roads of Metropolitan Significance - refers to roads identified in terms of the Urban Transport Act 78 of 1977.

All other Roads - Are dealt with in terms of Local Authority Legislation.

It is important to note that

< A national route (e.g. N2) can be a national road or a trunk road;

< A freeway (as defined under access terminology) can be declared a freeway in terms of Section 117 of the Road Traffic Act No. 29 of 1989 by the display of sign R401. This places restriction on the use of the road by certain classes of vehicle, pedestrians and livestock. Guidance signs on this type of road have a blue background;

< The legal definition defines statutory responsibilities. It does not describe road functionality as is required for planning and access management purposes.

4.3 ROAD HIERARCHY - FUNCTIONAL CLASSIFICATION SYSTEM

Functional classification, i.e. the grouping of roads by character of service they provide, was developed for land use / transportation planning purposes. The functional classification system mirrors the hierarchy of movement concept of six basic stages in any vehicle trip and includes a primary movement, transition, distribution, collection, access and termination. Within the road system one group of roads primarily serves long distance trips, which encompass the primary movement stage. Other groups of roads primarily serve shorter distance trips comprising the collection, access and termination stages.

This suggests that at the two extremes some roads serve essentially long distance movement functions and some serve essentially an access function. The road hierarchy concept is based on the premise that higher levels of access and mobility are mutually exclusive. Thus where mobility is required, less access is both desirable and practical. Where high levels of access are required the movement function is correspondingly less.

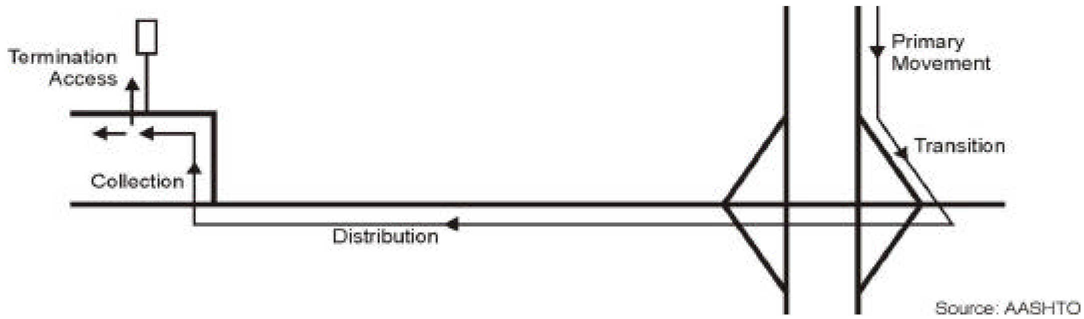


Figure 4.3: Hierarchy of Movement

In addition to 'distance of trip' and the 'provision of access' several other functional criteria are typically used to categorise roads within a hierarchy.

Volume of traffic - high order roads link numerous origin destination combinations, thus serve higher volumes of traffic during the primary movement stage of their trips. Low order roads serve the access needs of the adjacent properties;

Speed of travel - the appropriate travel speed is related to the amount of access required along the road. The more access, the lower the travel speed;

Freight movement - high order roads normally carry the bulk of long haul heavy goods vehicles. Lower order roads serve the distribution of these goods (and other services) to local destinations;

Public transport - middle order roads carry most of the public transport routes across the road system. Express bus / minibus taxi services, however, may be routed on higher order roads to reduce travel time;

Non-motorised transport - middle and lower order roads provide for pedestrian and bicycle movements.

4.4 ROAD CLASSIFICATION FOR URBANISED AREAS

The Department of National Housing 'Guidelines for the Provision of Engineering Services in Residential Townships' contains the following functional hierarchy, which is widely used.

Class	Type	Description
1	National and Regional Distributors (Trunk Roads)	These are predominantly rural roads whose main function is to facilitate regional distribution of traffic (Intercity movement)
2	Primary Distributors	This class of road forms the primary network for the urban areas a whole. All long distance traffic movements to, from and within the City should be focussed on such roads
3	District Distributors	These roads distribute traffic between the principal residential, industrial and business districts of the town and form the links between the primary network and roads within residential areas
4	Local Distributors	Local distributors are residential through roads which distribute traffic within communities and link distributors and access roads
5	Residential Access Roads	These roads give people direct access to buildings and land within neighbourhoods

On the other hand the American Association of State Highways and Transportation Officials (AASHTO) refers to:

< Urban principal arterials
< Urban minor arterials
< Urban collector streets
< Urban local streets

Both of the above hierarchical systems are used in South Africa and are a source of misinterpretation. Neither has been found satisfactory for the purpose of establishing access control guidelines. Several types of road can perform a similar function and yet have characteristics, which are distinct with regard to access control.

In particular, freeways and expressways need to be lifted out of the *principal distributor* functional category for special notice of their particular prohibitions on access. The recent interest in activity corridor developments has suggested the need for a special category for activity spines. In addition, the Community and Urban Services Support Project (CUSSP) makes reference to 'vehicle-only' routes and multi-functional roads. The latter are mixed pedestrian vehicle routes. A slightly different classification system is used in Western Australia.

In the interests of consistency a consolidated urban road hierarchy has been adopted. The table below provides a comparison between the various groups mentioned above.

Community Services	**CUSSP/Revised Red Book**	**Western Australia Community Code**	**AASHTO Urban**	**Consolidated Urban Road Hierarchy ***
Class 2: Primary Distributors	Vehicle only routes	Primary Distributors	Principal arterials	High order primary arterials
Class 3: District Distributors	Mixed pedestrian / vehicle routes (multi-functional roads)	Integrator arterials (distributors A and B)	Minor arterials	District distributors/ integrators
Class 4: Local Distributors		Neighbourhood Connectors	Collectors	Local distributors
Class 5: Residential Access Roads		Access streets and lane ways	Local streets	Access streets

* The higher order primary arterials are, in turn, divided into three categories, viz. Freeways, Expressways and Primary Arterials

4.5 RURAL ROAD CLASSIFICATION

As is the situation within urbanised environments various road classifications are referred to for rural roads.

The **AASHTO** divides roads into three main systems which, in turn, are subdivided. This is illustrated below.

Rural Arterial System	Rural Primary Arterials Rural Minor Arterials
Rural Collector Road System	Major Collector Roads Minor Collector Roads
Local Collector Road System	Access Roads

Using the American approach as a basis, the **Committee of State Road Authorities (CSRA)**, has classified road systems as follows:

Primary Roads - provide mobility in the national context. Traffic on these roads usually has long travel distances and the design of the roads makes provision for relatively high speeds and minimum interference to through traffic. (AASHTO classification: Rural Principal and Minor Arterial System).

Secondary Roads - provide mobility in the regional context. Shorter travel distances are experienced on these roads and more moderate speeds are consequently acceptable. This group of roads often forms the link between the towns not situated on the primary road network (AASHTO classification: Rural Collector System).

Tertiary Roads - are intended to provide access to properties and link them to the higher order routes in the hierarchy.

The rural road authorities in South Africa use various terms to describe roads. These have a legal basis and in the Province of the Western Cape include national, trunk, main, divisional and minor roads. In certain areas streets exist as part of a subdivisional area.

The notion of 'development corridors' within non-Metropolitan areas is gaining momentum. Central to this is a high order arterial, which endeavours to increase the levels of accessibility through higher mobility levels, between potential economic centres along the route. The notion is that increased accessibility will contribute to increased levels of inter-urban economic activities and, consequently, the economic potential for the region.

Within the context of improved access management, rural roads are consolidated as shown in the table below.

AASHTO Rural	CSRA System	Consolidated Rural Road Hierarchy *
Principal and Minor Arterials	Primary Roads	Higher Order Rural Arterials
Major and Minor Collectors	Secondary Roads	District Distributors
Local Roads	Tertiary / Access Roads	Local Distributors
		Access Streets

- The higher order rural arterials are, in turn, divided into three categories, viz. Freeways, Expressways and Primary Arterials.

4.6 CLOSED AND OPEN (MULTI-FUNCTIONAL) ROAD NETWORKS

For many years the concept of neighbourhood units or closed road networks has been favoured from an overall planning perspective. This township arrangement lends support to the protection of mobility on the arterial road system. However, this concept has been questioned in recent years. Increasingly, attention is being directed to the reintroduction of the concept of open networks or grid systems. It is argued that the latter

- Reduces the protection afforded to the private motor vehicle to the benefit of pedestrian movement, public transport operations and non-movement functions; and
- Provides increased flexibility in adapting to long-term changes in the function of the roads and the nature of the abutting land use activities.

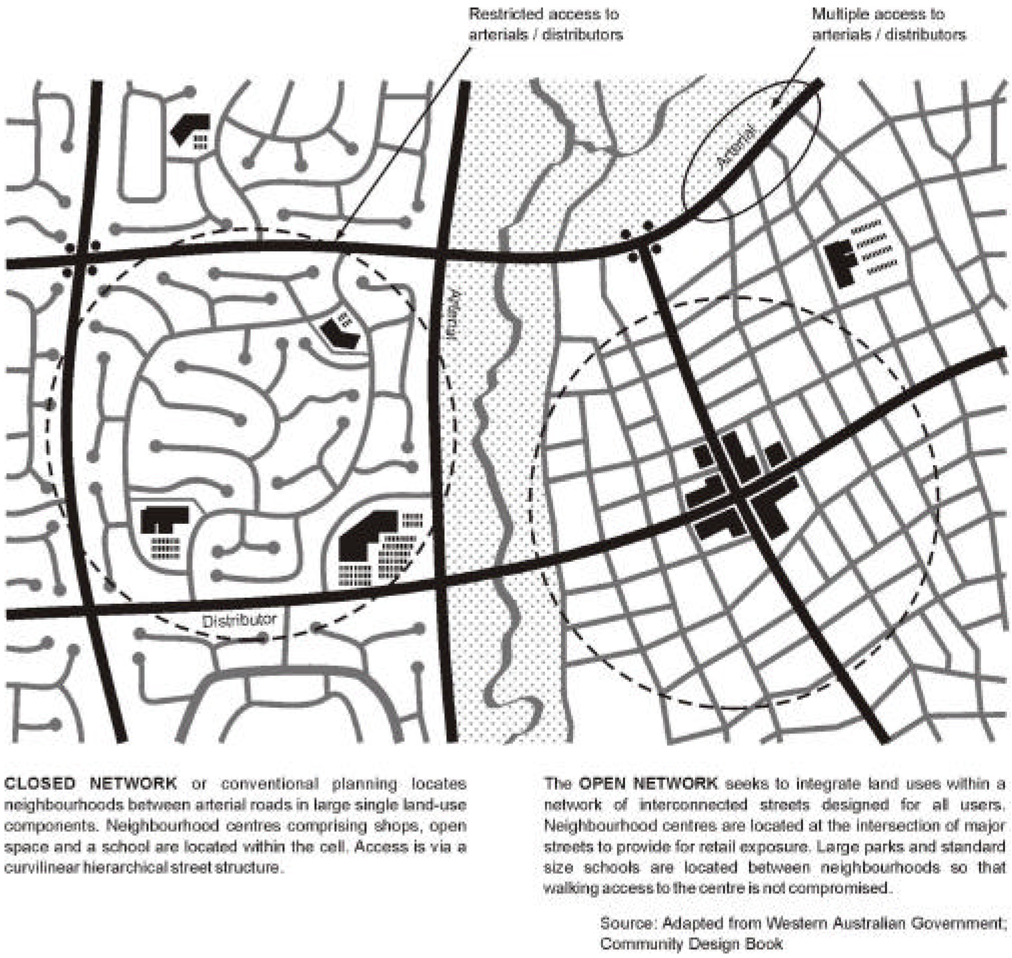


Figure 4.6: Comparison between Closed and Open Road Networks

The term ‘closed’ and ‘open’ are generic. Other networks referred to include radial, looped hierarchical, etc.

In the context of access management, both generic systems are recognised as needing accommodation. However, in all cases it is required that the access rules apply in the interest of safety and the protection of the higher order accessibility / mobility needs. The interface between open type systems and higher order arterials, must ensure that

< Intersection spacings are respected;

< Pedestrian access to or across these roads is appropriately handled, (traffic signalised crossings or grade separation).

In addition it is argued that if public transport is to be seriously promoted, increased attention needs to be given to pedestrian rights of way, walkable access to identified bus / minibus taxi routes and stops, and access controls which ensure mobility for public transport vehicles. This reinforces the need to classify roads within open networks.

4.7 CONSOLIDATED ROAD HIERARCHICAL CLASSIFICATION

Irrespective of the legal status of a road, the functional classification of rural and urban roads recognised in these guidelines is as follows:

High Order Arterials

Freeway - a high order arterial with special design features including medians, grade separations at all crossing roads, ramps at interchanges and, in some cases, ramps onto frontage roads;

Expressway - a high order arterial on which preference is given to through traffic by providing access connections with selected public roads only. Intersection spacings are large and access to private driveway connections is prohibited. Grade separated intersections may be found on these roads where at-grade intersection design cannot cope with traffic conflicts.

Primary Arterial - a high order arterial with at-grade intersections and restrictions on private driveway connections.

Distributors / Integrators / Collectors

District Distributor - a road that connects or passes through two or more districts. These roads often serve an activity corridor, supporting road-based public transport. Direct property access is permitted under certain circumstances.

Local Distributors - these roads serve important integration functions with increased levels of direct property access. They also support road-based public transport and can be termed as activity spines.

Access Roads - provide direct access to property.

CHAPTER 5

CHAPTER 5: INTERSECTION AND ACCESS CATEGORISATION

5.1 GENERAL

Within the context of road access management reference is made to *intersections,* which are the connecting points between public roads, and *accesses* (and driveways), which provide access to property. An interchange is a generic description given to a particular group of intersection types. Under certain circumstances access to property could be via an interchange.

The purpose of this chapter is to clarify a number of aspects pertaining to both intersections and accesses. It is important to appreciate that certain basic geometric characteristics must be adhered to when providing access to a public road. As roadside development becomes more intense, and as the geometric standards of the road become more demanding, so the interaction of the various characteristics becomes more complex.

5.2 GEOMETRIC DESIGN CONSIDERATIONS

When designing an intersection or access there is a wide range of geophysical and vehicle-operating characteristics that need to be considered. Some of these include

< Natural ground profile (flat, hilly or mountainous) and the effect on approach gradients;

< Sight lines to meet vehicle stopping distance criteria and, preferably, shoulder sight distance requirements;

< Design and operating speeds;

< Physical road layout - single or dual carriageway and number of lanes;

< Curvilinear nature of the roads, and effects of super-elevation and cross-over profiles;

< The presence of or need for heavy vehicle crawler lanes, bus stops and bus lanes, bicycle lanes, pedestrian facilities, etc;

< Intersection / access layout and control - at-grade, signalised, rotary, slip lanes, etc;

< Parking controls; etc

It is important to recognise that the more hilly the terrain and the more curvilinear the roads, the greater the attention that must be given to geometric design of the intersection or access. The detailed geometric design of the proposed intersection catering for the design traffic flows must be considered in terms of:

- TRH 17: Geometric Design of Rural Roads;
- UTG 1: Geometric Design of Urban Arterials;
- UTG 5: Geometric Design of Urban Collector Roads;
- UTG 10: Guidelines for the Geometric Design of Commercial and Industrial Local Streets;

as part of the Traffic Impact Assessment procedures. This process must test the locational acceptability of the desired access and the required lane configurations in order to fulfil acceptable levels of service including vehicle delay.

5.3 INTERCHANGES

An interchange is an intersection at which conflict between different traffic movements is resolved by introducing vertical separation between some or all of the movements. The complexity of the layout of the interchange may vary from separation of through flows only, with turning taking place at the level of the lesser movement, to separation of all movements. In general terms, reference is made to access interchanges and systems interchanges.

Access interchanges provide the linkages to the lower order road system, while ***systems interchanges*** are planned to handle high mobility movements at freeway to freeway intersections.

Access interchanges are generally of the simple diamond (narrow or wide), split diamond, or parclo types. Cloverleaf interchanges and multi-level directional interchanges are used in the design of systems interchanges.

Criteria for Interchange Spacings

Again, factors of design speed, the behavioural nature of traffic, in particular weaving movements that must be managed have an influence on the spacing of interchanges.

The length of ‘on’ and ‘off’ ramps must cater for acceleration and stopping needs respectively. Further, motorists need guidance information timeously available to them if they are to perform confidently within the system.

As a consequence the minimum desirable spacings between successive access interchanges is some 2,4 km (absolute minimum 2,0 km). Between a systems interchange and an access interchange 3,6 km is the desired minimum distance. The net spacing between systems interchanges is some 8 - 11 km. Refer **Section 3.4**. Distances are measured between the intersecting points of the approaching roadways.

5.4 AT-GRADE INTERSECTIONS

A wide variety of at-grade intersection types are encountered which fall into the following groups:

- T-type junctions - three approaches / legs;
- Y-type junctions - three approaches / legs;
- Cross-type intersection - four approaches / legs;
- Staggered intersections - four approaches / legs, left or right staggers;
- Multi-leg intersections - more than four approaches / legs.

Intersection controls are either by

- Priority control - yield or stop condition;
- Traffic signal control; or
- Rotary (mini or large diameter circle) movement control.

Within a particular intersection different controls could apply, e.g. a yield control slip lane within a signalised T-junction.

Two general rules that apply to the design of intersections are:

(a) No intersection should be planned for more than four 2-way intersecting legs;

(b) The angle of the crossing manoeuvres should be approximately 90° for movements intended to operate at high relative speed. The maximum departure from the 90° angle is recommended as 20°.

Measuring Intersection Spacing

The distance between intersections is normally the distance between the points where the extended centrelines of the adjoining approach roads meet with the centreline of the road. This is illustrated in **Figure 5.4**

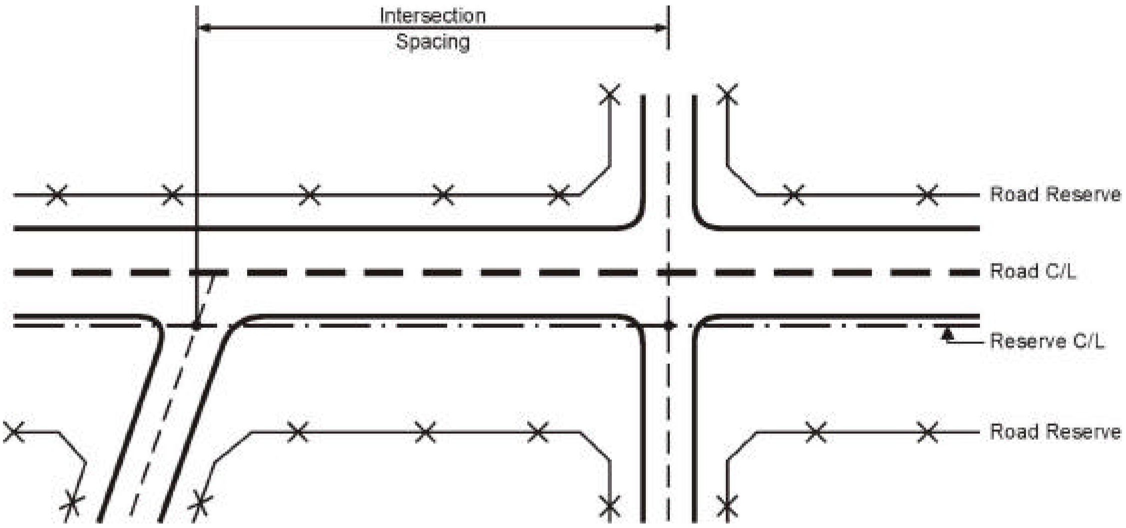


Figure 5.4: Measuring Intersection Spacings

It is assumed that *where a rotary intersection is to be used, this will be an alternative to a traffic signalised intersection. For large diameter rotary intersections the location where the approach road intersects with the circular travel way should be taken as the measurement point*.

5.5 PROPERTY ACCESS AND DRIVEWAYS

Vehicular access to any individual property is by way of a driveway.

In order to manage access provision it is convenient to categorise driveways as either ***low or high generator driveways***, or as ***equivalent local or district distributors***, based on the two-way traffic flows anticipated.

The driveway categories are set out in **Table 5.5(a)** below.

Table 5.5(a): Driveway Categories

Driveway Category	Development Environment				
	Urban	Intermediate	Suburban	Semi-Rural	Rural
	Vehicles per peak hour				v.p.day
Low generator	<50	<50	<50	<50	<50
High generator	>50	>50	>50	>50	
Equivalent Local Distributor	>250	>125	>100	>50	>50
Equivalent District Distributor	>450	>375	>300	>150	>500

The category of access which will normally be permitted is dependent on the roadside development environment, as well as the road functional category. **Table 5.5(b)** below, provides guidance on normally acceptable arrangements for such access.

It should be noted that access to single properties by way of ***high and low generator driveways*** is permitted off a limited number of road functional categories, whereas driveways of the ***equivalent local*** *or* ***district distributor*** categories are treated as a public road or street. An ***equivalent local distributor*** will normally be permitted direct access to a ***district distributor***, whereas an ***equivalent district distributor*** will normally be permitted direct access to a ***primary distributor*** provided, in both instances, respective spacings and geometric criteria are met. Access onto each road functional category will normally be by a ***public road*** *or* ***equivalent side road driveway*** one category down, but this is not a rigid requirement.

Zone 3 indicates cases where accesses may be ***high or low driveways*** and ***equivalent side roads***. Zone 2 indicates where driveway access would not be permitted, whereas ***equivalent side roads*** *and* ***other roads*** may be permitted access by way of suitable at-grade intersections; while Zone 1 requires access by way of interchanges only.

Table 5.5(b): Access Category Normally Permitted

Development Environment	Road Functional Category					
	High Order Arterials			Distributors		Access Road
	Freeway	Express-way	Primary	District	Local	
Urban	ZONE 1	ZONE 2	ZONE 3	ZONE 3	ZONE 3	ZONE 3
Intermediate	ZONE 1	ZONE 2	ZONE 3	ZONE 3	ZONE 3	ZONE 3
Suburban	ZONE 1	ZONE 2	ZONE 2	ZONE 2	ZONE 3	ZONE 3
Semi-Rural	ZONE 1	ZONE 2	ZONE 2	ZONE 2	ZONE 2	ZONE 3
Rural	ZONE 1	ZONE 3	ZONE 3	ZONE 3	ZONE 3	ZONE 3

Zone 1: Access by interchange only

Zone 2: Access by Public Road and Equivalent Side Road Driveway permitted

Zone 3: Driveway access permitted

Measuring Driveway Spacings

The measurement criteria for driveway spacing differs from that of intersection spacings (**Figure 5.4**) as is illustrated in **Figures 5.5(a), (b)** and **(c).** This difference is due to the shorter lengths applicable and the effects of geometric configurations. [Refer **Table 6.5.2** and **6.5.3 (a)** and **(b)**].

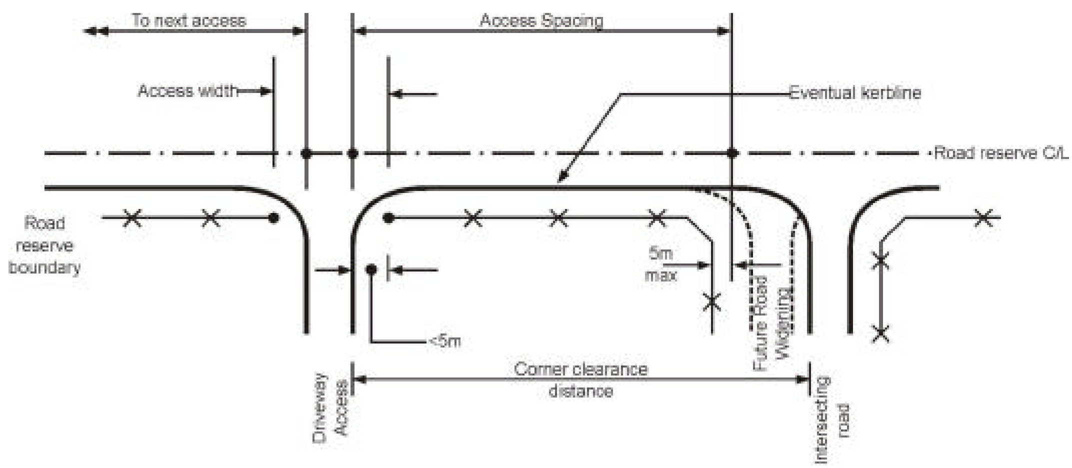


Figure 5.5(a): Measuring Access Spacings

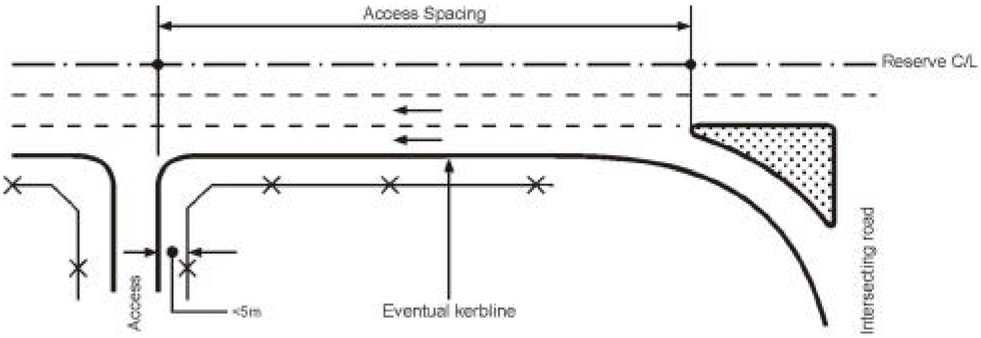


Figure 5.5(b): Measuring Access Spacings (Slip Road present)

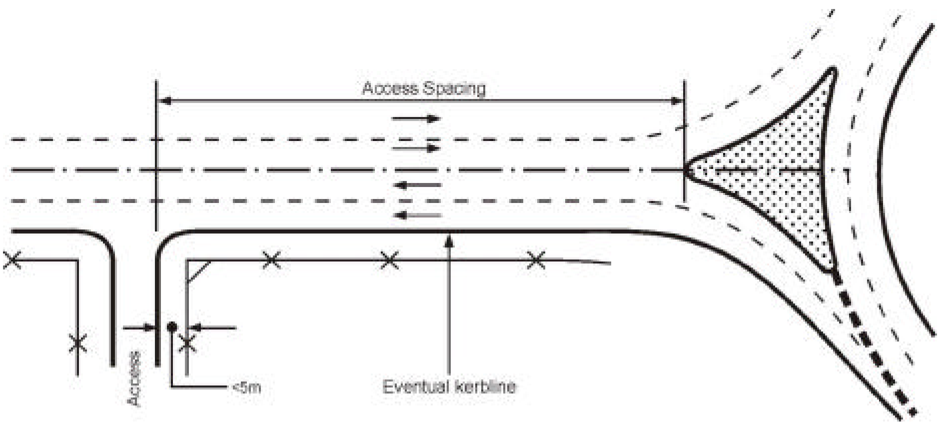


Figure 5.5(c): Measuring Access Spacings (Rotary present)

CHAPTER 6

CHAPTER 6: TECHNICAL CONSIDERATIONS AND APPROPRIATE ACCESS STANDARDS

6.1 GENERAL

In this Chapter the technical basis for the spacings between intersections and driveway accesses is formulated, and 'normal' spacing details are provided. The decision to permit an access is not to be based on the information on this chapter alone, but shall take cognisance of Chapters 7 and 8.

6.2 OPERATING SPEEDS

The underlying criterion used in the determination of intersection and driveway spacings is the operating speed on the road - that selected for each development environment is provided in **Table 6.2**.

Table 6.2: Operating Speeds (km/hr) for Spacing Criteria

Development Environment	Road Category				
	Freeway	**Expressway**	**Primary**	**District**	**Local**
Urban	80	60	50	40 - 50	35 - 40
Intermediate	100	70	60	50	50
Suburban	100 - 120	80	70	60	50
Semi-Rural	120	100	80	70	60
Rural	120	120	120	110	80

6.3 SIGNALISED INTERSECTION SPACING CRITERIA

The selected spacings for signalised intersections are given in **Table 6.3** below. This is followed by a discussion on how this was derived and such special cases deserving consideration.

Table 6.3: Summary of Normal Minimum Values for Signalised Intersection Spacings

Development Environment	High Order Arterials		Distributors	
	Expressways	Primary	District	Local
Urban	540	375	275	225
Intermediate	800	540	375	275
Suburban	1 200	800	540	375
Semi-Rural	1 600	1 200	800	540
Rural	ZONE 1			

Note: Zone 1 values not included, as operational speeds on these roads exceed 80 kph, which is inappropriate for traffic signalised control.

6.3.1 Optimum Location (basic case)

This is illustrated in **Figure 6.3.1** A uniform spacing, based on the optimum location, permits a 'throughband' equal to the green time. The throughband width indicates the amount of traffic that can pass through a series of signals during the green phase.

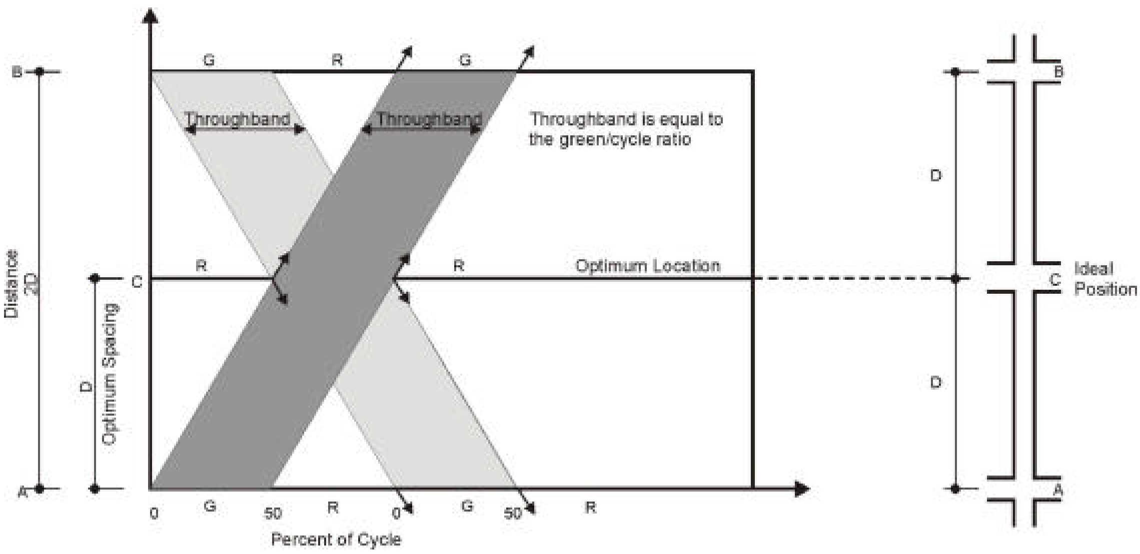


Figure 6.3.1: Standard Case - Optimum Location

If the signals are placed away from the optimum location, there is a corresponding reduction in the 'throughband'.

When standard 4-leg intersections are considered, placing a signal at 'C' which is midway between 'A' and 'B' at a distance 'D', allows a full 'throughband' in both directions. A vehicle travelling at operating speed for a time equal to one half of the cycle length will cover a distance 'D', thus the consecutive signals are said to be spaced at one half cycle offsets. The 'throughband' is shown as the distance between the parallel directional arrows.

The optimum spacing of signals depends on the cycle length and operating speed. The optimum spacing can be given as

$$D = \frac{CV}{2} \quad \text{where}$$

D = intersection spacing (m)
C = cycle length (sec)
V = operating speed (m/sec)

At the optimum distance, there is no loss in throughband. When signals are placed at non-optimum locations, there is a loss in 'throughband' and delay increases.

6.3.2 Determination of Ideal Signal Spacings

The signal spacings selected were derived with two basic criteria in mind:

- The standard case two-way progression is the primary criterion. Typical operating speeds, cycle lengths and green time/cycle time ratios are used to derive the ideal signal spacings, which are adjusted taking cognisance of the ‘percentage throughband’ for the various road / development environment combinations.
- A secondary criterion is the relation of the signalised intersection spacing to the unsignalised intersection spacings. The objective being that of deriving signal spacings, which are multiples of the unsignalised intersection spacings.

Satisfying these objectives requires slight adjustments to the ideal signal spacings derived for standard case 2-way progression.

Table 6.3.2(a) gives typical operating speeds for Various Road / Development Environment combinations. Operating speeds are higher for the less densely developed environments and the higher order roads.

Table 6.3.2(a): Typical Operating Speeds (km/hr)

Development Environment	Road Category			
	High Order Arterial		Distributor	
	Expressway	Primary Distributor	District Distributor	Local Distributor
Urban	60	50	40	35
Intermediate	70	60	50	40
Suburban	80	70	60	50
Semi-Rural	100	80	70	60

Similarly, **Table 6.3.2(b)** gives typical cycle lengths. Cycle lengths are longer for the higher order roads and less densely developed environments.

Table 6.3.2(b): Typical Cycle Lengths (seconds)

Development Environment	Road Category			
	High Order Arterials		Distributor	
	Expressway	Primary Distributor	District Distributor	Local Distributor
Urban	70	60	55	50
Intermediate	80	70	60	55
Suburban	110	80	70	60
Semi-Rural	120	110	80	70

Table 6.3.2(c) gives ideal signal spacings. The ideal spacings increase as operating speed and cycle length increase.

Table 6.3.2(c): Ideal Signal Spacings for Operating Speeds and Cycle Lengths

Development Environment	Road Category			
	High Order Arterials		Distributor	
	Expressway	Primary Distributor	District Distributor	Local Distributor
Urban	583	417	305	243
Intermediate	778	583	417	305
Suburban	1222	778	583	417
Semi-Rural	1666	1222	778	583

6.3.3 Percentage Throughband Assumptions

Table 6.3.3(a) gives the assumed green/cycle ratios and the resulting 'Percentage Throughband' for the through lanes on the main road; these being based on a series of 5-signalised intersections.

Table 6.3.3(a): Assumed Green/Cycle ratios for through Lanes on the Main Road

Development Environment	Road Category			
	High Order Arterials		Distributor	
	Expressway	Primary Distributor	District Distributor	Local Distributor
Urban	50%	50%	45%	40%
Intermediate	50%	50%	50%	45%
Suburban	55%	50%	50%	50%
Semi-Rural	55%	55%	50%	50%

These green/cycle ratios represent the maximum 2-way throughband, which could be achieved with perfectly spaced and co-ordinated signals. Generally, a 1% deviation from ideal uniform spacing results in a 1% reduction of throughband width at each signal after the first one.

Differences between **Table 6.3** adopted normal minimum spacings and the ideal spacings in **Table 6.3.2(c)** are shown below.

Table 6.3.3(b): Distance Deviations - Table 6.3 vs Table 6.3.2(c)

Development Environment	Road Category			
	High Order Arterials		Distributor	
	Expressway	Primary Distributor	District Distributor	Local Distributor
Urban	43m (7,4%)	42m (10%)	30m (10%)	18m (7,4%)
Intermediate	22m (2,8%)	43m (7,4%)	42m (10%)	30m (10%)
Suburban	22m (1,8%)	22m (2,8%)	43m (7,4%)	42m (10%)
Semi-Rural	67m (4,2%)	22m (1,8%)	22m (2,8%)	43m (7,4%)

Since four signals are encountered after the first signalised intersection, the percentage reduction in throughband-width is four times the percentage distance deviation. For example a 7,4% distance deviation will yield a 29,6% reduction in throughband-width (4 x 7,4% = 29,6%). If throughband-width were 50% in the ideal case then it would be (1 - 0,296) x 50% or 35,2% in the adjusted case.

'Percentage Throughbands' are given in **Table 6.3.3(c)** are for a series of five signals at the spacings of **Table 6.3.**

Table 6.3.3(c): 'Percentage Throughband' for Signal Spacings of Table 6.3 and Green/Cycle Ratios of Table 6.3.3(a) - (Set of 5 signals)

Development Environment	Road Category			
	High Order Arterials		Distributor	
	Expressway	Primary Distributor	District Distributor	Local Distributor
Urban	35%	30%	25%	28%
Intermediate	44%	35%	30%	27%
Suburban	51%	44%	35%	30%
Semi-Rural	46%	51%	44%	44%

The above 'percentage throughbands' are greater than or equal to the suggested acceptable values given in **Table 6.3.3(d)** below.

Table 6.3.3(d): Suggested Acceptable 'Percentage Throughband' for Signal Location

Development Environment	Road Category			
	High Order Arterials		Distributor	
	Expressway	Primary Distributor	District Distributor	Local Distributor
Urban	35%	30%	25%	20%
Intermediate	40%	35%	30%	25%
Suburban	45%	40%	35%	30%
Semi-Rural	45%	45%	40%	35%

6.3.4 Variance on Signal Spacings

Two situations can arise where arguments can be made for variations on the signal spacings of **Table 6.3**. The *first case* involves accesses, which require little green time in relation to other side street green time demands. In this case the signal can be shifted and the '% throughband' through the adjacent signals can still be accommodated. The *second case* involves the argument that the position of the signalised access should only be restricted to the minimum 'percentage throughband' identified for the road. In that case the 'percentage throughband' at the adjacent signals is not the controlling factor, only the portion of that throughband which satisfies minimum requirements is of concern.

(a) Additional Green Time at Access Signal: Matching Throughband at Adjacent Signals

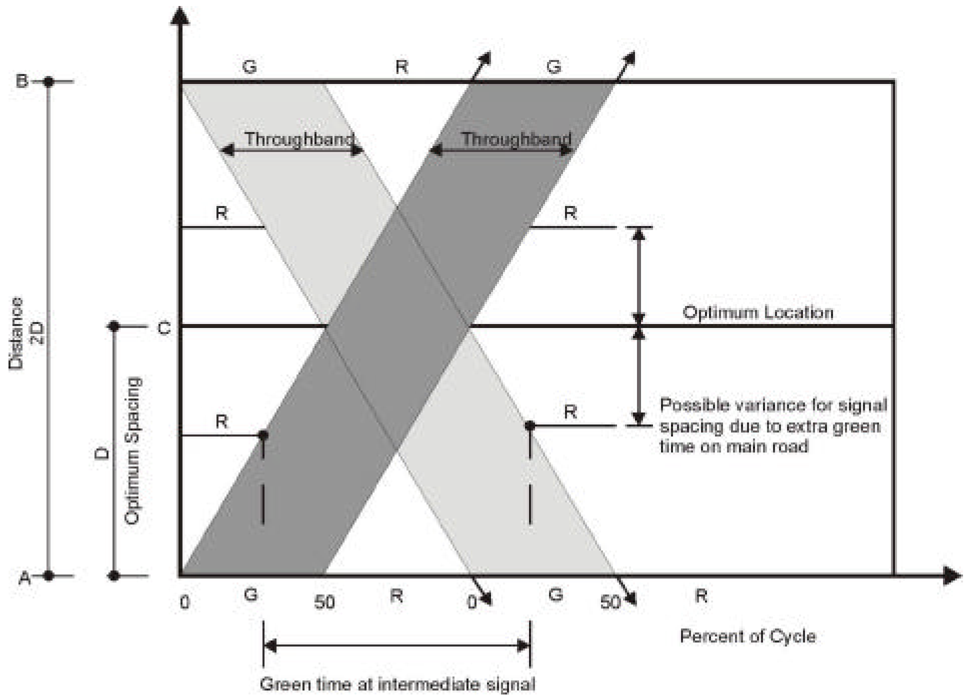


Figure 6.3.4(a): Matching Throughband at Adjacent Signals

As shown in **Figure 6.3.4(a)** the variance possible is related to the additional green time that the main road has at the intermediate (site) signal position.

Any argument for variance on signal spacings must however consider future upgrading to upstream and downstream intersections, which would improve the greenband through those intersections. The site signal position and main road green time at the site signal must combine to accommodate the upgraded greenband.

(b) Throughband Greater than Minimum All Along the Main Road Matching the Minimum Percentage Throughband Required

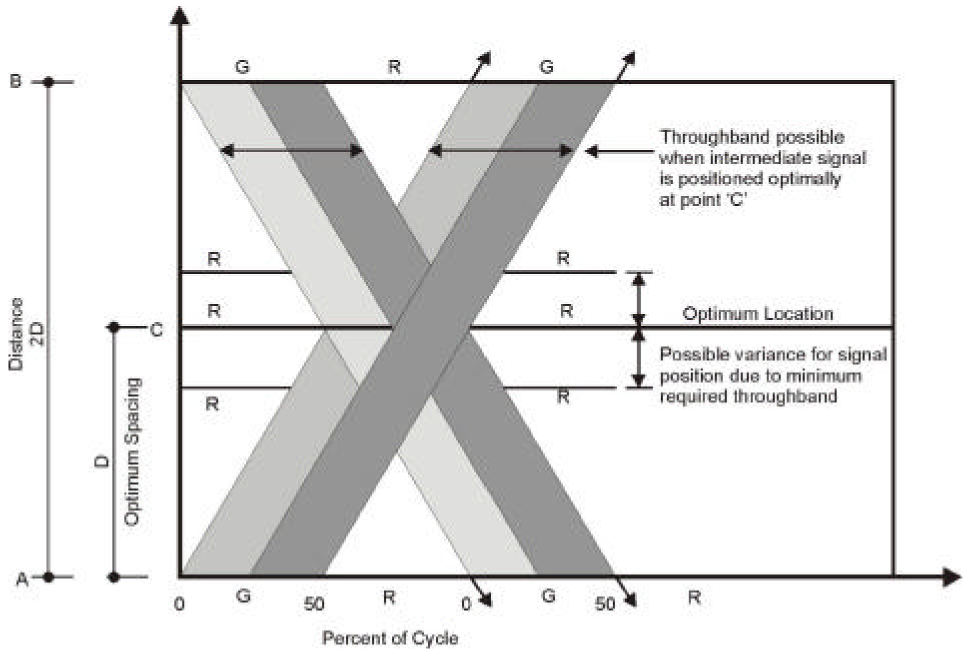


Figure 6.3.4(b): Matching the Minimum Percentage Throughband

As shown in **Figure 6.3.4(b)** the variance possible is related to the additional 'percentage throughband' that the main road has over the minimum required. A surplus like this is related to high green time/cycle time ratio for the main road through lanes and also the near ideal signal spacings for signals along the road.

It is recommended that site development access positions not be allowed to dictate the 'percentage throughband' for the main road. Rather the intersections of the public road system should dictate the 'percentage throughband' with which the site access positioning must comply.

6.3.5 Non-optimum Signal Positioning

(a) Single Signal out of Position

There is a 1% reduction in throughband width at each signal after the first one for every 1% deviation from the optimum distance 'D' as shown in **Figure 6.3.5(a)**. At optimum distance 'D' the throughband width equals the green/cycle ratio (i.e. 50%).

When the signals are located midway at point 'Y' between the optimum location 'C' and the signal at 'A', a 50% change in distance (0,5 D) results. The throughband is then reduced by 50% as calculated by [(1-0,5) x 50% = 25%]. This reduction is shown by the narrowing between the directional arrows in **Figure 6.3.5(a)**.

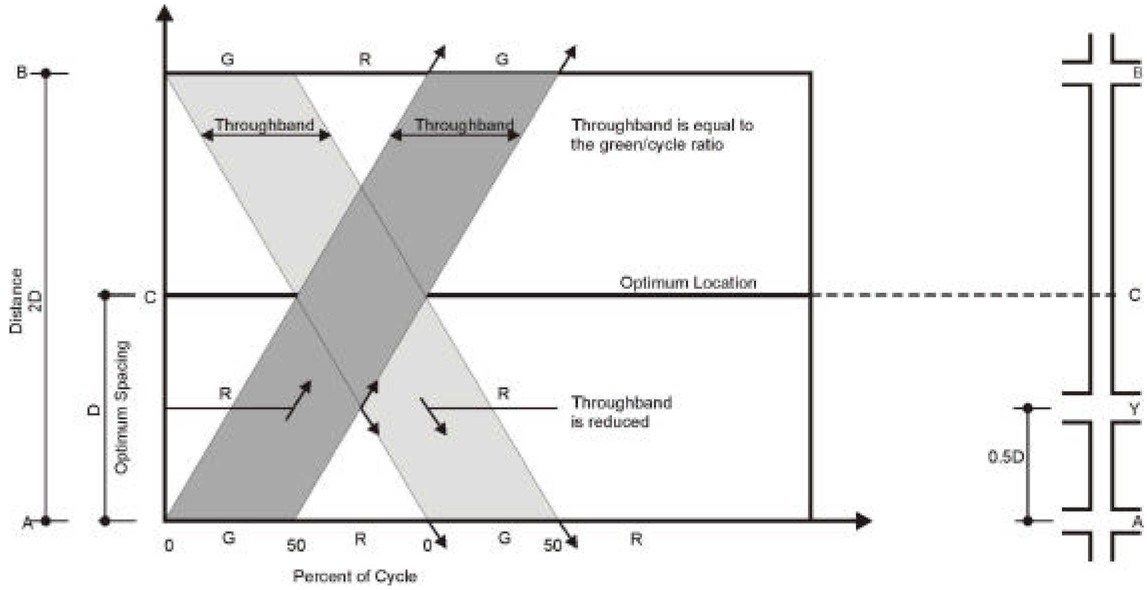


Figure 6.3.5(a): Non-Optimum Location Single Signal

(b) Series of Signals at Inappropriate Uniform Signal Spacing

In this case a series of signals is not spaced at half cycle travel distances. Unless the flexibility exists to change the signal cycle length or the speed of travel between signals, there will be a loss of throughband.

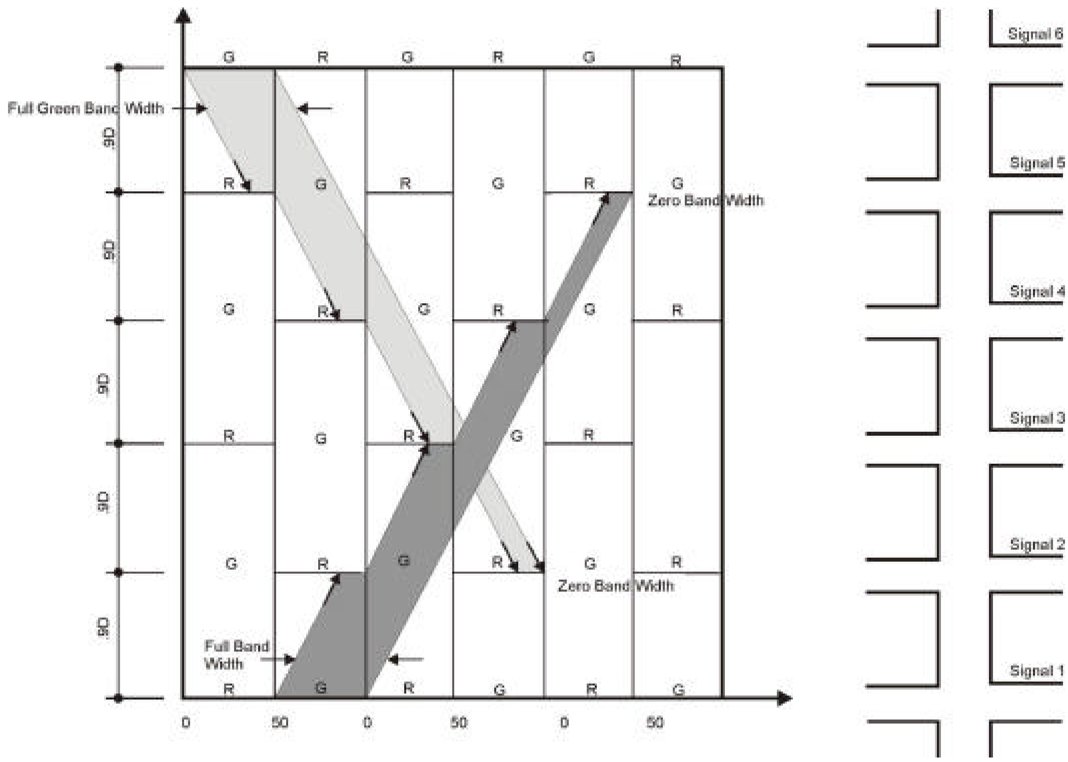


Figure 6.3.5(b): Inappropriate Uniform Signal Spacing

Figure 6.3.5(b) shows that for every signal encountered at non-ideal spacing there is a reduction of 1% of throughband width for every 1% deviation from the *theoretical* ideal distance. The calculations below illustrate the effect for a 10% distance deviation when ideal throughband width is 50% of the cycle.

No of Signals	**Percent Reduction**	**Remaining Throughband Width**
3 signals	2 x 10% = 20%	(1-.2) x 50% = 40% of cycle
4 signals	3 x 10% = 30%	(1-.3) x 50% = 35% of cycle
5 signals	4 x 10% = 40%	(1-.4) x 50% = 30% of cycle
6 signals	5 x 10% = 50%	(1-.5) x 50% = 25% of cycle

6.3.6 Special Cases

Case 1: T-Junctions at the Start or End of Arterials

The important feature of a T-Junction at the end of an arterial is that simultaneous two-way movement cannot occur at the T-Junction. The main street traffic arriving at the T-Junction and side street traffic entering the main street can only do so sequentially.

Figure 6.3.6(a) shows the optimum location of an intersection at the end of an arterial, at point 'C', in relation to two other signals at intersection 'A' and junction 'B'. The ideal distance between 'C' and 'B' is D/2 and the signal timings are offset by a quarter cycle. This allows the last vehicle from the side street to enter the main street just as the first vehicle of the main street platoon arrives at the T-Junction at point 'B'. Simultaneous two-way movement, however, is maintained at the signal at point 'C'.

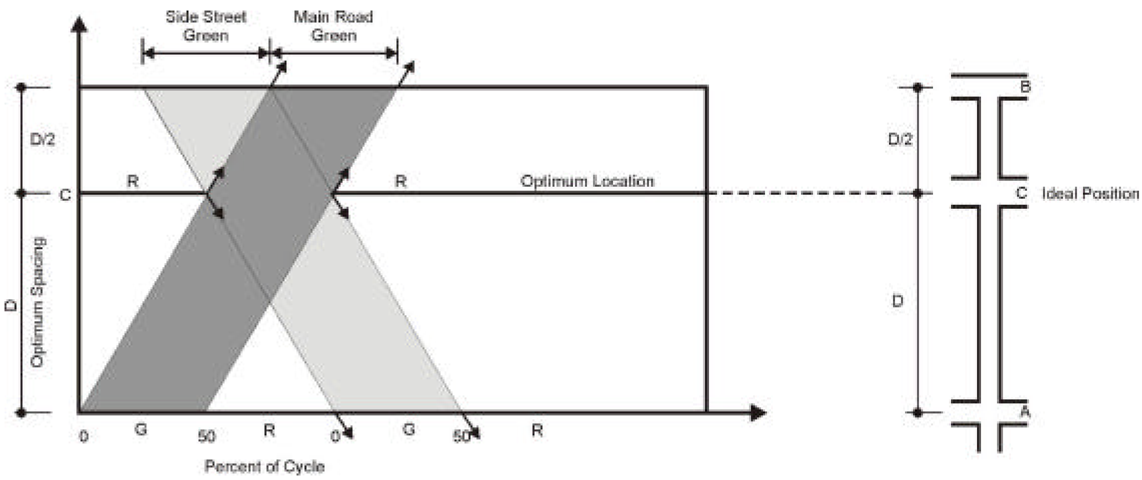


Figure 6.3.6(a): Case 1: T-Junctions at the Start or End of Arterials

Case 2: T-Junction Spacing Along an Arterial

The spacing of T-Junctions at locations other than that of ideal standard intersection spacing based on cycle length and operating speed, is dependent on two factors:

- The necessity of providing an advance phase for the main street right turn vehicles;
- The ability to reduce side street green time to provide enough green time for partially sequential movement of main road vehicle platoons.

Where the location of a T-Junction is in question and provision can be made for the above two factors, the optimum spacing of the T-Junction can be determined as shown in **Figure 6.3.6(b)**. Locating the new signal at point 'E', closer to the side requiring the advance, allows an advance phase for the first portion of the throughband for the one direction followed sequentially by the simultaneous movement of both platoons. These platoons consist of the remainder of the first platoon and the first part of the opposite platoon.

Thereafter the remainder of the opposite platoon moves through the intersection.

It is important to note the percentage green time required is greater than for the standard case. This is because the platoons pass the intersection in a somewhat sequential manner instead of completely simultaneously as in the standard case. The side street green time is thus correspondingly less and volumes which can be handled are less than for the standard case.

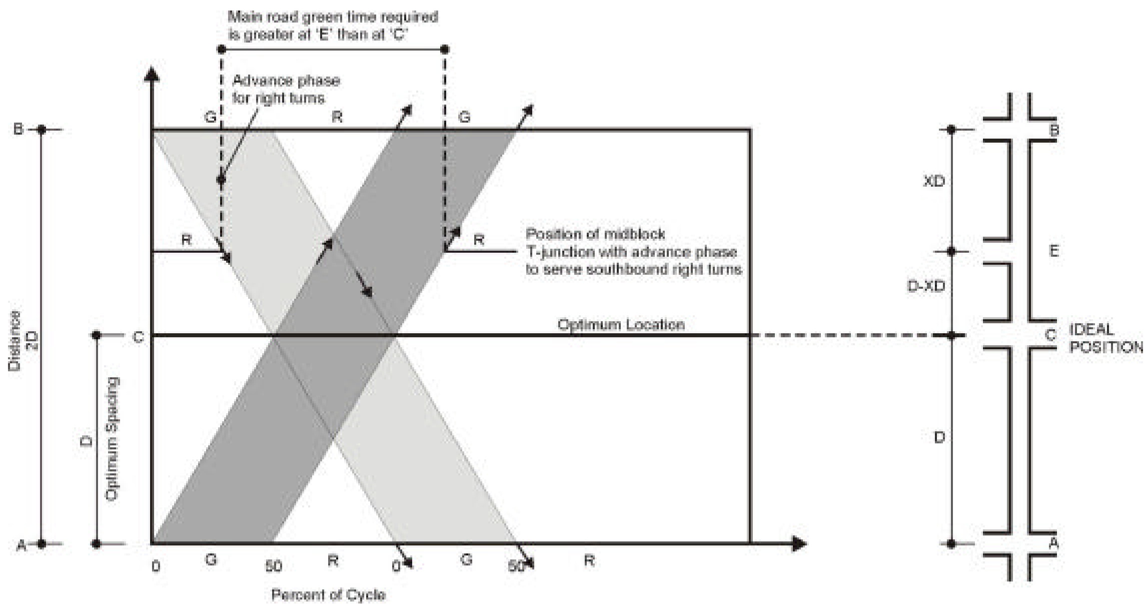


Figure 6.3.6(b): Case 2 - T-Junction Spacing along an Arterial

6.4 UNSIGNALISED SPACING CRITERIA

Within this section consideration is given to the development of appropriate standards for unsignalised intersection and driveway access spacings. These are developed from an evaluation of various operational factors that comprise:

- Functional boundary criteria;
- Stopping sight distance;
- Left-turn criteria;
- Egress capacity criteria;
- Egress conflict (access vs access) criteria;
- Communication criteria;
- Weaving criteria.

The outcome of this is presented as appropriate access standards for each road type and development environment in **Section 6.5**.

6.4.1 Functional Boundary Criteria

AASHTO states that: "*Driveways should not be situated within the functional boundary of at-grade intersections. This boundary would include the longitudinal limits of auxiliary lanes.*" In order to reduce multiple conflicts and provide adequate reaction time, the functional area should be comprised of the manoeuvre distance to perform lane changes and deceleration, plus any required storage length. Please refer to **Figures 6.4.1(a) and (b).**

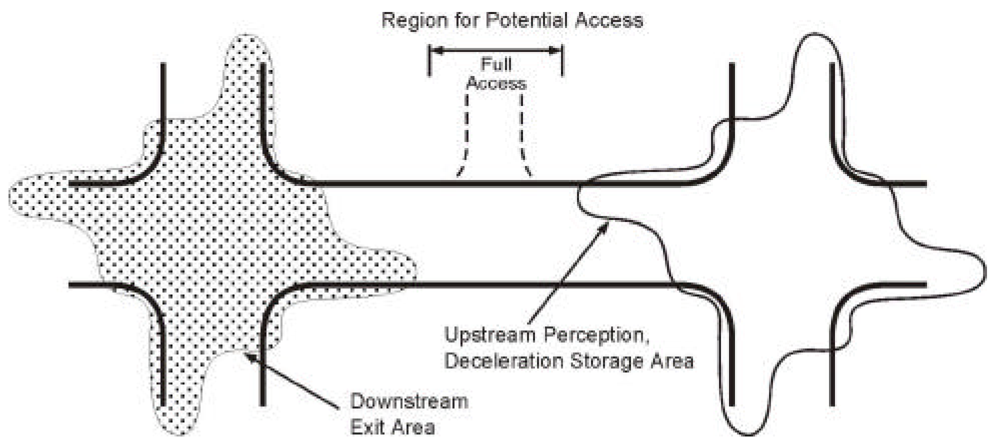


Figure 6.4.1(a): Functional Boundary Concept

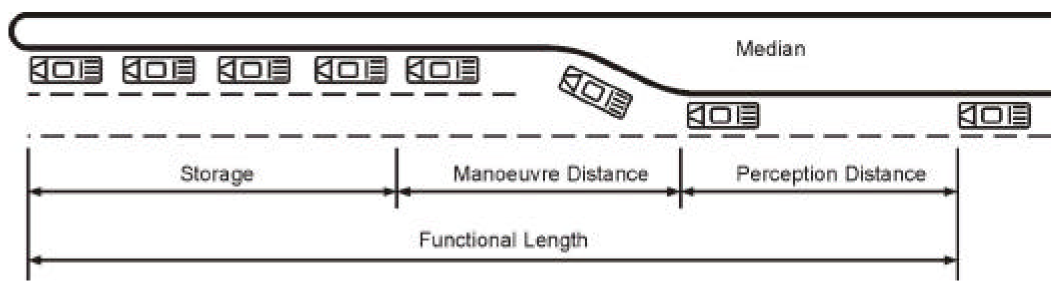


Figure 6.4.1(b): Elements of the Functional Area of an Intersection

The AASHTO statement in effect provides intersection corner clearance requirements for driveways. However, the concept of functional boundary is used in these guidelines to provide spacing requirements between unsignalised accesses for certain road category/ development environments. The result is that these unsignalised accesses are spaced at distances larger than the limits of their functional boundaries.

As seen in **Figure 6.4.1(a)** the functional boundary distance is comprised of three elements. The storage length element obviously varies on a site by site basis. In order to provide some minimum functional boundary guideline an assumption of a minimum perception time of 1,5 seconds and storage length of 30m is used.

When these are added to deceleration lane lengths recommended in DoT report RR 91/233 then the minimum spacings of **Table 6.4.1** are determined.

Table 6.4.1: Functional Boundary Criteria

Speed (km/hr)	Minimum Spacing for Unsignalised Intersection Driveways (m)*			
	Perception	Deceleration	Storage	Total
50	21	70	30	120
60	25	100	30	160
70	29	139	30	190
80	33	170	30	230

* rounded to the nearest 5m

For ‘Left In / Left Out’ accesses the upstream functional boundary spacings are roughly 32m less than ‘shown’ above. The deceleration distance is 2m less (final velocity of 10 km/hr instead of 0 km/hr) and the storage requirement of 30m is eliminated.

The functional boundary criteria are applied in these guidelines to higher order roads where higher operating speeds and the predominance of the movement function over the access function justifies larger access spacings.

6.4.2 Stopping Sight Distance Criteria

DoT report RR 91/233 states that 'stopping sight distance (SSD) should be maintained in all situations, including driveways, so as to allow a driver in a through lane to monitor only one driveway at a time and, if necessary, to stop to avoid conflict. This will reduce accident potential.'

AASHTO minimum stopping distances for various operating speeds are given below in **Table 6.4.2.**

Table 6.4.2: AASHTO Minimum Stopping Distance

Speed (km/hr)	Distance (m)
32	35
40	45
48	60
56	80
64	100
72	120
80	145

6.4.3 Left Turn Conflict Criteria

DoT report RR 91/233 states that, "*As an absolute minimum, especially on minor arterials where demand for access is high, minimum spacing criteria should be based on left turn conflict (LTC) criteria.*"

Left turn conflict refers to the conflict between a through vehicle and a vehicle turning left out of a driveway. LTC spacing criteria assume that the driver of a through vehicle must perceive the egress vehicle and decelerate to avoid a collision. As with the stopping sight distance criteria, the LTC spacing criteria allows drivers in the through traffic stream to consider one access driveway at a time.

This spacing requirement is lower than for stopping sight distance criteria because the through vehicle is not required to decelerate to a stop. Through traffic is required to decelerate only to the speed, which the egress vehicle has attained, on the through lane (e.g. 21 km/hr for main road speed of 50 km/hr). Left turn conflict spacing criteria are given below in **Table 6.4.3**.

Table 6.4.3: Left Turn Conflict: Minimum Access Spacing

Speed (km/hr)	Centre to Centre of Access (m)
50	44
60	62
70	80
80	106

6.4.4 Egress Capacity Criteria

The existence of gaps acceptable to drivers exiting an unsignalised access increases as the distance between accesses increase. This is because movements to and from accesses degrade the distribution and size of gaps in the through traffic stream.

Accesses spaced at distances greater than 1,5 times the distance required to accelerate to through traffic operating speed result in improved traffic absorption. **Table 6.4.4** below provides minimum access spacing to provide maximum egress capacity.

Table 6.4.4: Maximum Egress Capacity: Minimum Access Spacing

Speed (km/hr)	Spacing (m)
30	60
40	110
50	185
60	290
70	430
80	600

6.4.5 Access vs Access (Egress Conflict)

Vehicles entering the traffic stream from adjacent driveways have equal rights of way. Frequently neither is able to predict the intended manoeuvre of the other. Unless sufficient spacing is provided between adjacent driveways the two vehicles' trajectories may conflict requiring some evasive manoeuvre (e.g. braking).

A minimum separation of 25m is recommended to allow a vehicle at a downstream access to enter the roadway just after a vehicle at an upstream access has entered the roadway. At this distance the upstream vehicle (which is travelling slowly and accelerating) will not have to slow down.

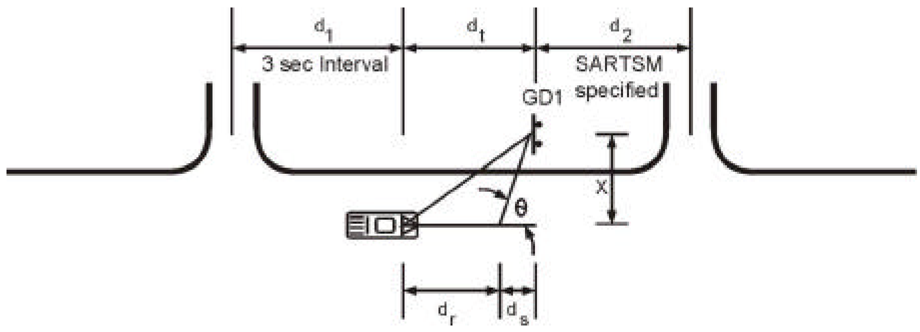
6.4.6 Communications Criteria

At certain locations on the road network it is necessary to consider the influence of information transfer to the driver and to ensure that this is transmitted to and managed by the driver in an appropriate manner. This is of particular importance on high volume roads where complex manoeuvres such as lane changes or weaving may be required by drivers who are unfamiliar with the road environment.

The drivers must manage a variety of information including navigating, road following, traffic interaction, rule compliance and various non-traffic related tasks.

This is a complex issue, but for the purpose of these criteria the following is considered appropriate.

A motorist having passed a conflict point on the road must be given adequate time to detect and read a road traffic guidance sign, absorb and process the information and undertake the appropriate selective action. The assumption is that no other conflict point may be located so that it will interfere with this process. The situation is illustrated in **Figure 6.4.6**.



GD1	=	advance guidance sign
d_1	=	stabilizing distance - 3 sec interval
d_2	=	distance from GD1 to intersection as given in the SARTSM
d_t	=	$d_r + d_s$
d_r	=	available reading distance
d_s	=	distance to sign after sign has dis appeared from drivers acceptable cone vision.

Figure 6.4.6: Communication Criteria

The formula used to determine d_t is:

$$d_t = 0{,}278\ V\ (0.32N - 0.21)\ D + X / \text{Tan}\ È$$

where	V	=	Speed of vehicle (km/hr)
	N	=	'Bits' of information displayed
	D	=	Environmental distraction factor
	X	=	Lateral displacement of sign
	È	=	Horizontal or vertical cone of vision (15E or 7E resp).

The following values have been chosen to provide realistic worst conditions that must be catered for:

	Urban	**Rural**
V (km/hr)	60 & 80	100 & 120
N	10	8
X (m)	16	17
D	1,5	1,25

The outcome is provided in **Table 6.4.6.**

Table 6.4.6: Information Transfer Criteria, Minimum Intersection Spacing

Speed	d_1	d_2	d_t		Rounded Total	
			Urban	Rural	Urban	Rural
50	42	100	122		260	
60	50	120	135		310	
70	58	135	147		340	
80	67	170	160	129	400	370
90	75	210	172	137	460	420
100	83	280		145		510
110	92	320		153		570
120	100	350		160		610

6.4.7 Weaving Criteria

Weaving actions referred to are illustrated in **Figure 6.4.7**. This has particular relevance to the higher order arterials where higher operating speeds are present. A potential access should be located beyond the minimum weave length indicated in **Table 6.4.7**. The distance indicated is a function of the amount of weave action and operating speeds, and site specific considerations.

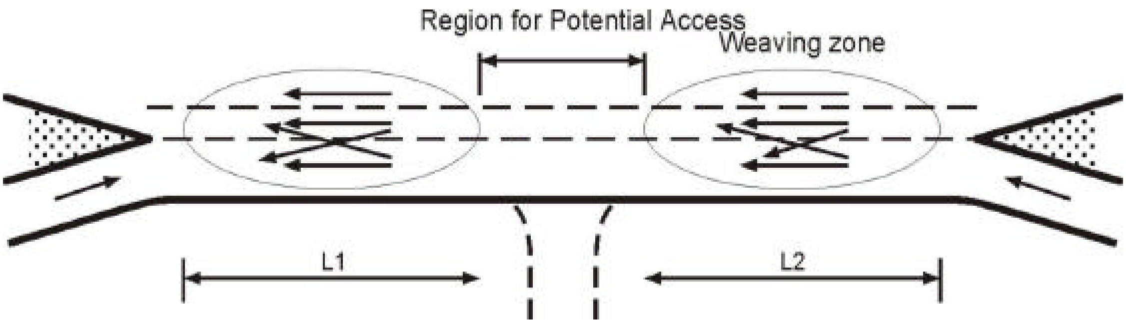


Figure 6.4.7: Weaving Criteria

Table 6.4.7: Minimum Weaving Lengths

Speed (km/hr)	50	60	70	80	90	100	120	130
Absolute minimum weaving length (m)	100	135	175	220	265	325	385	450

6.5 APPROPRIATE ACCESS STANDARDS

Operational factors identified for the determination of the access spacings have been described in this chapter and, in summary, include

(a) The optimal spacing of signalised intersections (SIG). These being logical long term entry locations.

(b) Intermediate unsignalised priority intersections and accesses;

< egress conflict criteria (EC);

< left turn conflict criteria (LTC);

< stopping sight distance (SSD);

< functional boundary distance (FBD);

< communication criteria (CC);

< weaving distance criteria (WDC).

The selection of appropriate criteria for access spacing requirements has, in addition, considered four main determinants.

Firstly, the planned density of development and guiding planning philosophy heavily influence the number of vehicle trips and the road hierarchy through which vehicle trips are aggregated and distributed. Intersections spacings are thus directly influenced by planning factors.

Secondly, the need for traffic signals (or rotaries) to manage traffic conflicts at major at-grade intersections combined with operating speed objectives for the major road determines allowable signal spacing. For most major roads in urbanised areas, some intersections will be signalised and intersection spacings are thus affected.

Thirdly, the need to separate conflict areas along the road determines unsignalised access spacings. The conflict areas are the result of changes to vehicle speed and direction near the access points.

Fourthly, the need to ensure that information is provided to the motorist in such a manner so as to minimise the possibility of misinterpretation and inappropriate action. This includes positioning of road signs and other traffic control devices together with the geometric configuration of the road.

When driving, the driver's task is to receive and process mainly visual inputs. The driver will be stimulated by some, make predictions and decisions about actions to be taken, execute the necessary actions and observe the outputs of these actions while processing other information inputs. Each element of the road should be designed to take cognisance of the driver needs to take in information, process this information and react in an appropriate safe manner. Allowance must be made for the fact that the driver is not alone on the road. A wide range of traffic density needs to be considered, as well as in-vehicle distractions and other ambient influences.

As the density of development increases, the traffic generated per unit of area, is assumed to increase. However, at the same time the road network is assumed to take on a finer pattern as the development environment changes from 'rural' at the one extreme to 'urban' at the other. The finer pattern spreads the higher traffic volumes to a larger number of connecting roads. To some extent, this mitigates the higher traffic volumes generated per unit area.

The equivalent side street spacings have been developed, taking cognisance of criteria such as the signal spacings (sig), information or communication (cc) and stopping sight distance (ssd). For the higher and lower traffic generator driveway situations other criteria have been applied. That selected is illustrated in **Tables 6.5(a)** and **6.5(b)**.

Table 6.5(a): Normal Minimum Operational Criteria for Access Spacing (Assuming permitted Driveways are High Traffic Generating)

Development Environment	High Order Arterials			Distributors		Access Road
	Freeway	Express-way	Primary	District	Local	
Urban	WD	SIG	SSD	FBD	SSD	EC
Intermediate	WD	SIG	SSD	FBD	SSD	EC
Suburban	WD	SIG	FBD	FBD	SSD	LTC
Semi-Rural	WD	SIG	FBD	FBD	SSD	SSD
Rural	WD	CC	CC	CC	CC	SSD

Table 6.5(b): Normal Minimum Operational Criteria for Access Spacing (Assuming permitted Driveways are Low Traffic Generating)

Development Environment	High Order Arterials			Distributors		Access Road
	Freeway	Express-way	Primary	District	Local	
Urban	WD	SIG	SSD	LTC	EC	EC
Intermediate	WD	SIG	SSD	LTC	EC	EC
Suburban	WD	SIG	FBD	FBD	LTC	LTC
Semi-Rural	WD	SIG	FBD	FBD	SSD	SSD
Rural	WD	CC	CC	CC	CC	SSD

It needs to be emphasised that the access spacings have, to a certain extent, been subjectively determined. Further empirical studies may be warranted to improve on the quality of the outputs.

6.5.1 Normal Access Spacings for Side Street Equivalent Driveways

Side street equivalent driveways include the district and local equivalent categories. All equivalent district distributor driveway locations should be based on the traffic signalised intersection spacings, while this is optional for equivalent local distributor driveways. (The need for traffic signals would be dependent on a warrant existing. The use of rotary control is not precluded as an alternate solution).

The normal optimal spacings for signalised intersections are given in **Table 6.5.1** below.

Under exceptional circumstances an equivalent district distributor may link with a freeway via an interchange.

Table 6.5.1: Summary of Optimal Signalised Intersection Spacings and Equivalent District Distributor Access Spacings (normal minimum values)

Development Environment	High Order Arterials		Distributors	
	Expressways	Primary	District	Local
Urban	540	375	275	225
Intermediate	800	540	375	275
Suburban	1 200	800	540	375
Semi-Rural	1 600	1 200	800	540
Rural	ZONE 1			

Note: Zone 1 values not included, as operational speeds on these roads exceed 80 kph, which is inappropriate for traffic signalised control.

6.5.2 Normal Access Spacings for 'Equivalent Local Distributor' Driveways

An equivalent local distributor driveway may access an expressway, primary arterial, district or local distributor at locations other than traffic signalised intersections in accordance with the minimum access spacing values given in **Table 6.5.2**. Refer also **Section 5.5** for access rules and measurement criteria.

Table 6.5.2: Equivalent Local Distributor Access Spacings (normal minimum values)

Development Environment	High Order Arterials				Distributors			
	Expressways		Primary		District		Local	
	FA	LO	FA	LO	FA	LO	FA	LO
Urban	540	540	120	90	90	75	60	60
Intermediate	800	800	180	120	120	90	90	75
Suburban	1 200	1 200	270	160	180	120	120	90
Semi-Rural	1 600	1 600	400	200	270	155	180	120
Rural	1 600	1 600	600	600	450	450	450	450

Note: FA refers to a full access (all turning movements permitted) which is not signalised. A full access implies a median break where it can be accommodated under the future traffic condition.
LO refers to a 'left only' situation. Where a 'left in' to a site is located at distance LO from a preceding intersection or access, a 'left out' if provided shall not be provided more than 15m from the 'left in' whereafter it shall be deemed to be a separate access.

6.5.3 Normal Minimum Access Spacings for 'High' and 'Low' Generator Driveways

Driveways of this type may access primary arterials, district and local distributors in certain environments only. Refer **Table 6.5.3(a) and (b)**.

Table 6.5.3(a): 'High Generator' Driveways, Access Spacings (Normal Minimum Values)

Development Environment	High Order Arterials				Distributors			
	Expressways		Primary		District		Local	
	FA	LO	FA	L0	FA	LO	FA	L0
Urban			120	75	60	60	45	45
Intermediate			180	100	75	75	60	60
Suburban							60	60
Semi-Rural								
Rural	600	600	500	500	450	450	300	300

Note: *Refer to notes under 6.5.2*

Table 6.5.3(b): 'Low Generator' Driveway Access Spacings (Normal Minimum Values)

Development Environment	High Order Arterials				Distributors			
	Expressways		Primary		District		Local	
	FA	LO	FA	L0	FA	LO	FA	L0
Urban			60	60	45	45	25	25
Intermediate			90	90	45	45	25	25
Suburban							45	45
Semi-Rural								
Rural	600	600	500	500	450	450	300	300

Note: *The notes under 6.5.2 apply.*

6.5.4 Location of Median Openings

In situations where full unsignalised driveway access are inappropriate due to the volume of traffic on the roadway, consideration may be given to providing median breaks at locations as indicated in **Table 6.5.4** to allow for U-turns. These should only be considered where geometric circumstances are suitable and where an analysis of the roadway performance has indicated that the use of median breaks is acceptable.

Table 6.5.4: Location of Median Breaks

Development Environment	High Order Arterials		Distributors	
	Expressways	Primary	District	Local
Urban	540	120	90	60
Intermediate	800	180	120	90
Suburban	1 200	270	180	120
Semi-Rural	1 600	400	270	180
Rural	1 600	600	450	300

CHAPTER 7

CHAPTER 7: ARTERIAL (ACCESS) MANAGEMENT PLANNING

7.1 GENERAL

In the previous chapter the normal access standards were identified, while in **Chapter 8** attention is given to certain special situations that also need consideration. The concern is that this may lead to excessive *ad hoc* decisions being made on access provision.

Chapter 7 therefore endeavours to emphasise the need to view access provision in the context of the roadway and of the corridor as a whole. The Arterial (Access) Management Plan aims to balance the demand for access to land with the need to preserve the flow of traffic on the subject roadway and overall road network.

It needs to be appreciated that much of the future road system already exists. However, as the demand for land use changes continue, so too will the need to review aspects of the road network and the potential to meet the ever changing demands. This may lead to additional roads or road links being provided, or require that additional capacity is added. In certain cases, this could be problematic or considered inappropriate, in which case innovative solutions will have to be sought to relieve unacceptable levels of traffic congestion or unsafe situations.

7.2 ESTABLISHING AN ARTERIAL MANAGEMENT PLAN

The process of establishing a road or arterial management plan entails:

- The *categorisation of the road network* - reference must be made to other planning in the vicinity, and authority consensus is required on the categories identified;
- The *identification and categorisation of the road development environment* - again reference to other studies and consensus reaching is required;
- *Establishment of existing* (and existing non-conforming) *intersections and access needs*;
- *Determining the road carrying capacity* and implementation dates for planned upgradings;

- *Determining traffic flow*, both current and future relative to the arterial / road and intersection / access; with special attention being given to heavy goods vehicles, public transport, pedestrians and bicyclists needs;
- The *compiling of an Arterial Management Plan*;
- *Consultation* with interested and affected parties;
- *Formal acceptance of the plan* by the relevant authorities;
- *Periodic review and update.*

In effect, *the Arterial Management Plan should fix the nature of the road in relation to the surrounding corridor and, in turn, inform on the extent to which changes in land use, access provision and road capacity can be tolerated.*

7.3 UPGRADING OF AN EXISTING ARTERIAL

Arterials are generally upgraded as a consequence of a failure of a road pavement, a lack of adequate vehicular capacity, or the presence of a safety hazard.

The notion of upgrading needs to be extended to consider the utilisation of the road reserve space, in catering for present and future traffic demand by giving attention to the

- appropriate traffic mix;
- promotion of public transport;
- inclusion of traffic control devices;
- accommodation of pedestrians, bicyclists and trading needs;
- parking requirements; and
- need for landscaping and street furniture.

7.4 THE NEW ROAD OR BYPASS SITUATION

Access decisions must be taken on the basis of the Arterial Management Plan. This, in turn, will reflect the long term situation which may include the construction of an alternate new road or bypass which aims to relieve the road in question of through traffic. (Refer **Chapter 3**).

It is imperative that the Integrated Development Plan for the area reflects the intention to provide such ***an alternate route****.* It is ***also*** important ***that the Arterial Management Plan takes full cognisance of the situation, and that this information is readily accessible to potential developers and other interested parties. Where no alternate route is possible, the Arterial Management Plan must reflect this situation, as it must influence future access decision-making.***

When considering the bypass, trade-offs need to be made between the financial earnings from passing trade and whether these adequately compensate the community in terms of rates income, money circulation and employment (socio-economic issues) when seen against the social and environmental impacts of severance, safety, mobility, noise, air pollution, etc (environmental capacity issues).

7.5 LAND USE / ACCESS CHANGE MANAGEMENT

In addition to focussing attention on the potential to upgrade a road, or provide for a bypass, it is possible within the framework of the Arterial Management Plan to promote and systematically manage changes to the land use structure. Sight should not be lost of the reality that land uses change and that buildings are recycled. These create opportunities to affect amendments to the access arrangements, internal on-site circulation and parking arrangements over time. This is illustrated in **Figures 7.5(a), (b), (c) and (d)** below

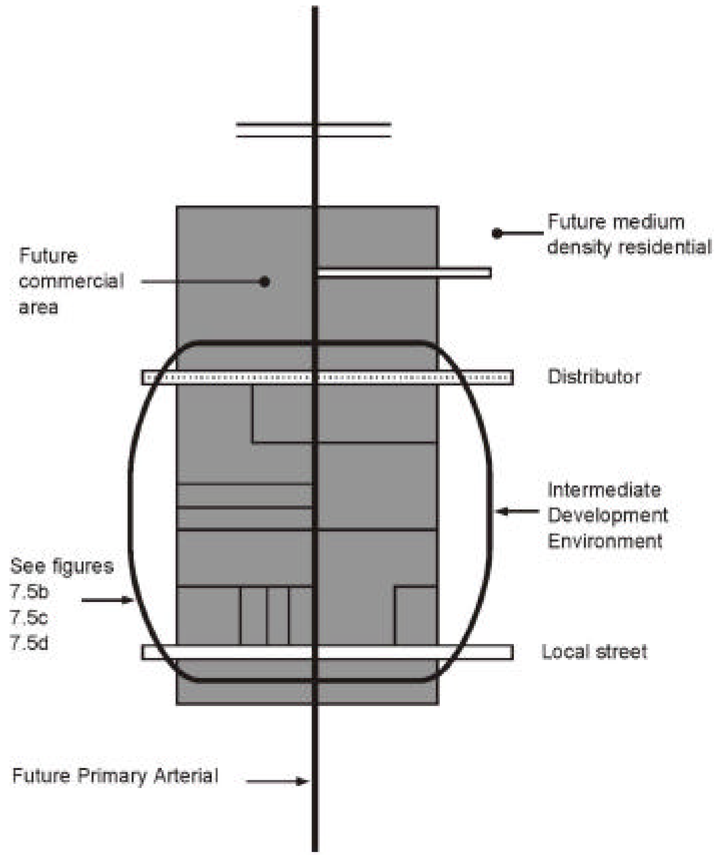
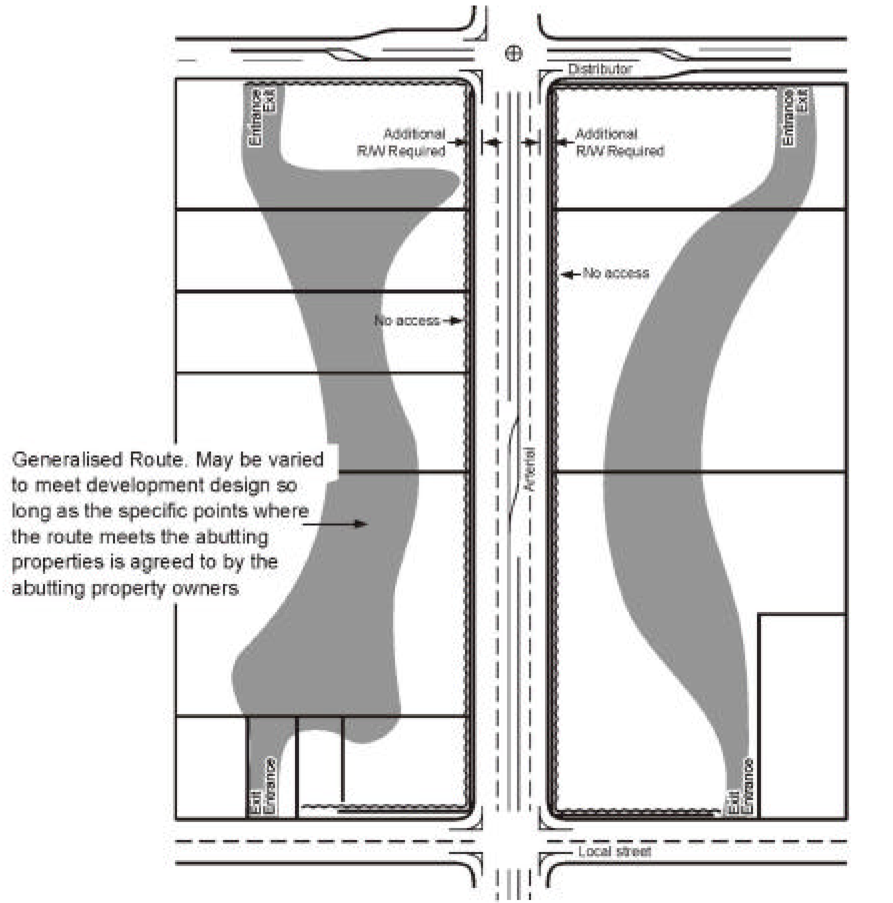
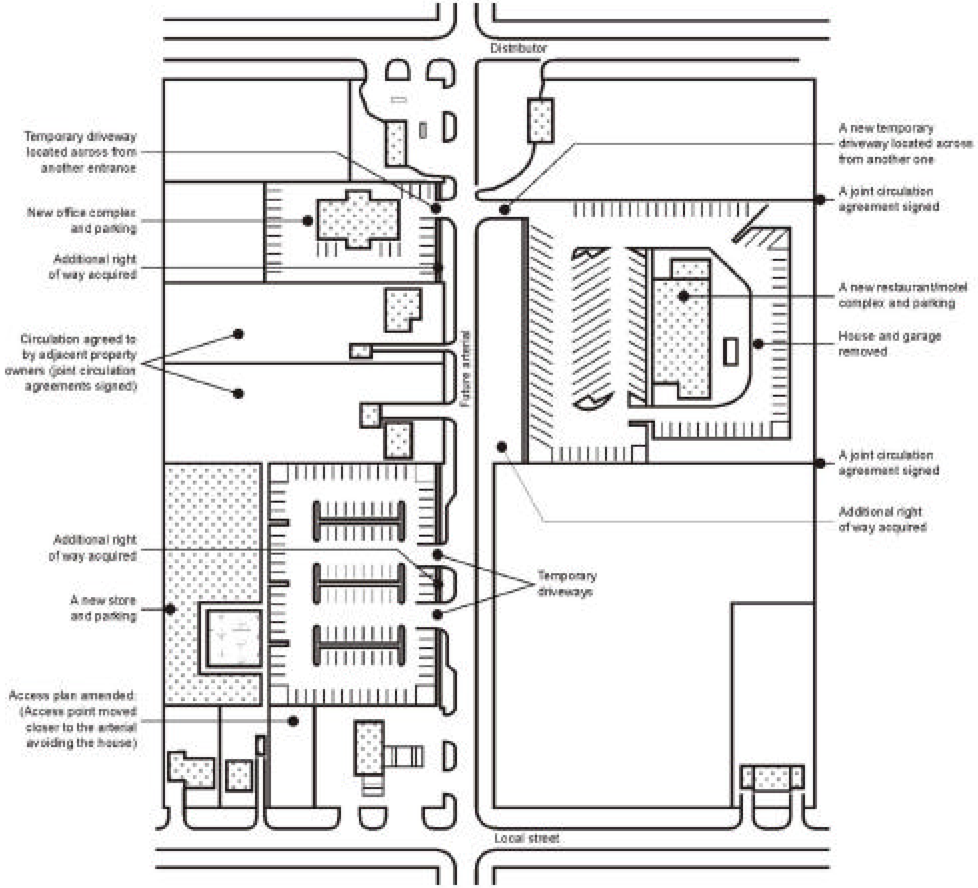


Figure 7.5(a): Development Planning for an Arterial

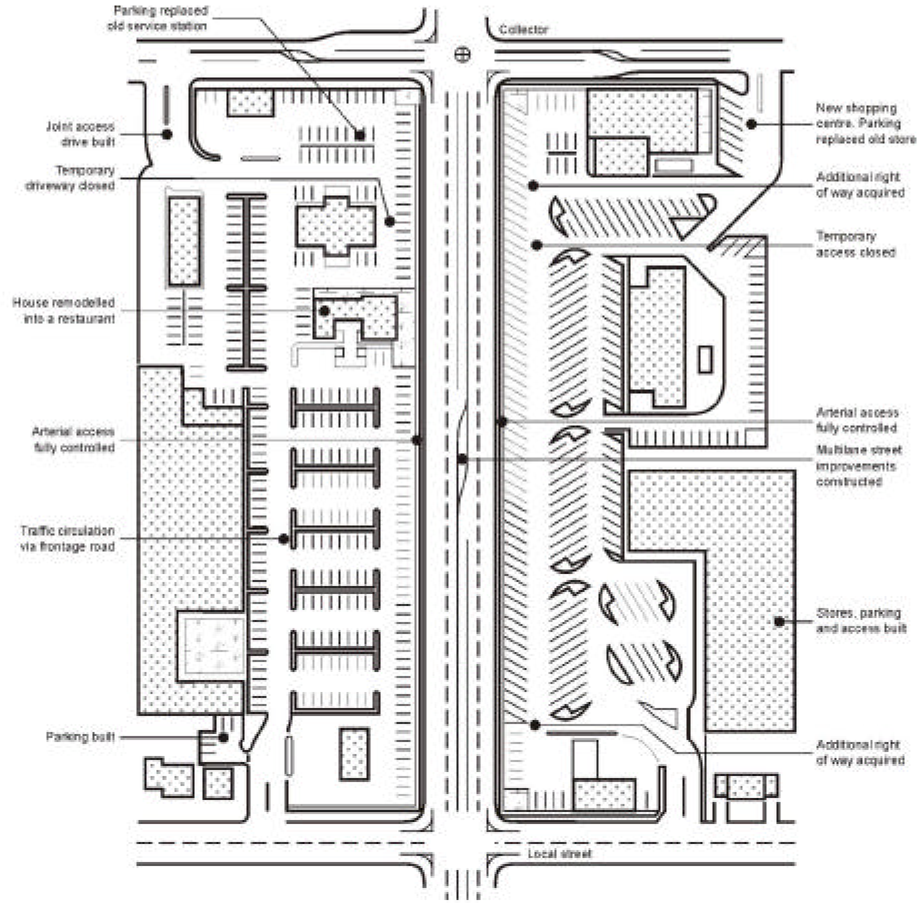


Shown is the original management plan for the development area of Figure 7.5a.
It identifies the agreed vision for access at full development.

Figure 7.5(b): Development Planning for the Arterial



An interim access configuration to suit the development of the corridor. Temporary accesses and joint circulation agreements between adjacent property owners are established, all within the vision of the ultimate access management plan.



The final (actual) access management plan 15 years after plan approval. The original version has been adhered to, access and site circulation have taken on definition through the process of development.

Figure 7.5(c): Interim Access Management Plan (Year 10)

Figure 7.5(d): Final Access Management Plan (Year 15)

CHAPTER 8

CHAPTER 8: ASSOCIATED ISSUES

In this Chapter attention is given to certain additional issues, which can significantly impact on a decision to permit a driveway access. Generally the planning horizon in terms of access provision is relatively short term. The road, on the other hand, will serve a far longer public purpose, which will be well in excess of the 20-year planning horizon. Decisions taken now need to take cognisance of this.

Consequently, this Chapter deals with some of these additional access-related issues that need consideration.

8.1 SINGLE CARRIAGEWAY AND MULTI-LANE ROADWAYS

The foregoing chapters have not specifically dealt with a number of situations, which may be present on the road system. These include the treatment of accesses onto:

< single carriageway two-way roadways;
< undivided multi-lane roads;
< divided multi-lane roads.

Also included are roadways with dedicated:

< crawler lanes and passing lanes;
< bus lanes;
< bicycle lanes.

The approach adopted is that the access spacing criteria still apply in each of the above situations; however, cognisance needs to be taken of site specific realities. The *Traffic Impact Statement or Study and policies adopted in the Arterial Management Plan need to be respected*. In addition, the following needs to be considered.

(a) Traffic flows on the through road may be such that an intermediate median break or signalised intersections is unacceptable. Where this is in conflict with the access policy for such a road, access should not be permitted.

(b) 'Left in' and 'left out' movements need to be structured so as to minimise the risk of undesirable turning movements occurring.

(c) Where full access is not possible, consideration must be given to an alternate access to an adjacent street.

(d) No access should be permitted in a **transition zone**, i.e. where the number of lanes present increases or decreases. In this regard, any future road improvement/layout should also be accounted for, where possible.

(e) No access should be permitted where suitable geometric standards are unattainable. In particular, attention must be given to road vertical alignment.

(f) Where a **priority bus lane** is located adjacent to an outer road edge no direct property access should be permitted. This is of particular importance in an activity corridor where both dedicated public transport lanes and high density mixed land use activity is desirable. It is argued that the presence of driveway accesses (and road side parking) reduces the efficiency of the bus lane, increases the safety risk and limits the interaction between the bus lane and the activity areas. Where the bus lane is located in the median area, median breaks should not be allowed. This is an important arterial management issue.

(g) Similarly, bicyclists on a dedicated **bicycle lane** are placed at considerable risks where multiple accesses occur. Again, this is an arterial management issue.

8.2 FRONTAGE OR SERVICE ROADS

On higher order roads it is often feasible to accommodate the demand for access on a physically separated frontage or service roadway. Such a frontage road should be appropriately classified and access to it managed accordingly.

Important is the design of intersections where the frontage road meets with a crossing street, or links to a ramp system. This is illustrated in **Figures 8.2(a)** and **(b)** respectively.

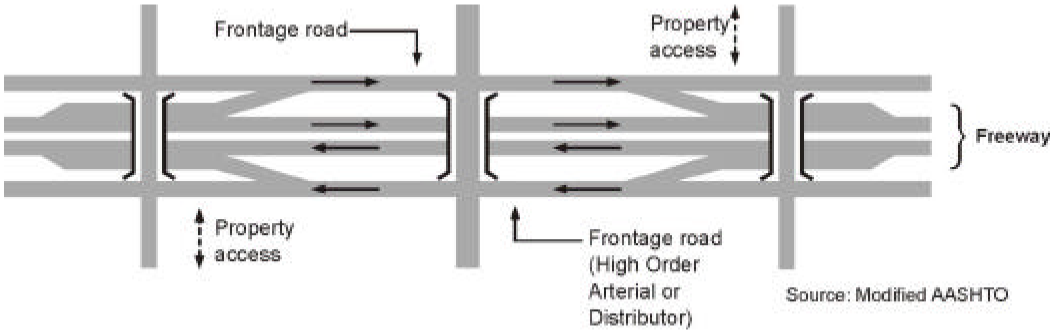


Figure 8.2(a): Example of Frontage Road Treatments

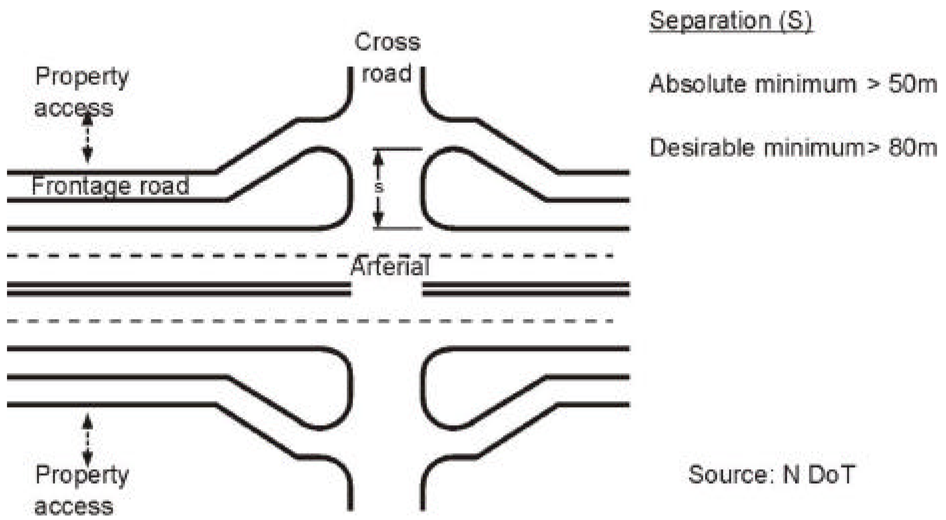


Figure 8.2(b): Example of Frontage Road Treatments

Roads of this type must be integrally designed with the higher order parallel route and form part of the Arterial Management Plan for the higher order road.

8.3 TURNING LANES AND TAPERS

Included is the requirement to provide right turn lanes and left turn lanes and/or deceleration tapers. These are illustrated in **Figure 8.3.1**.

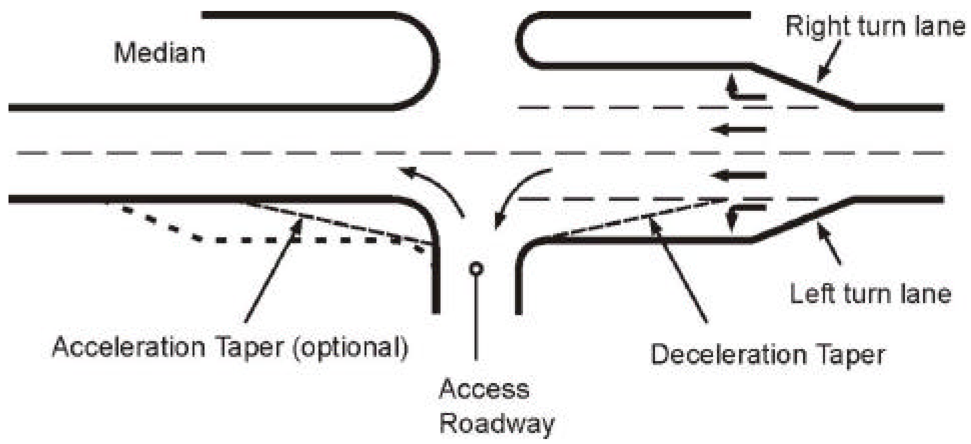
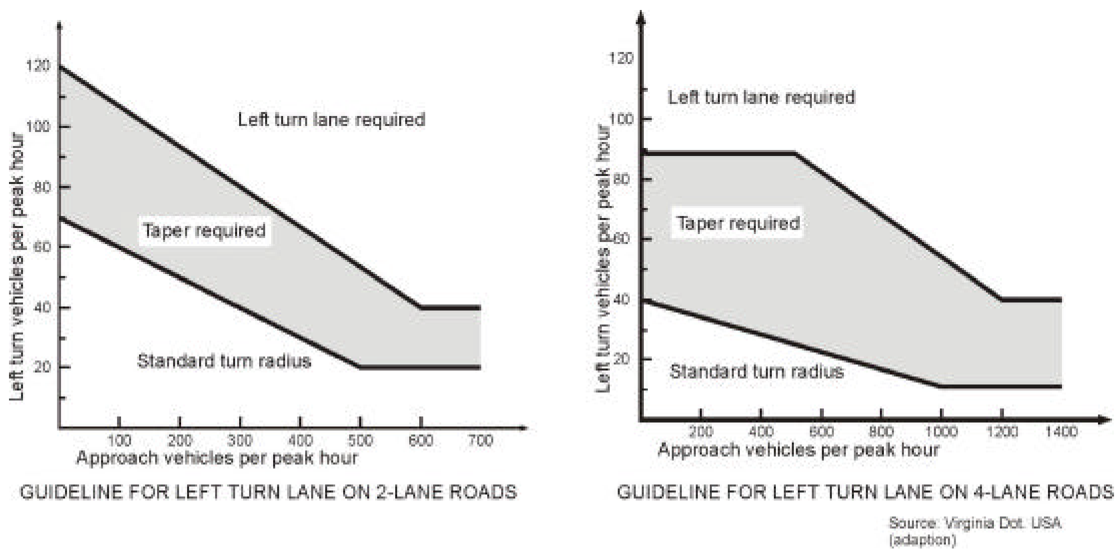


Figure 8.3.1: Turning Lanes and Tapers

Figure 8.3.2(a) and **(b)** provide guidelines for the provision of left turn lanes or tapers for two lane single carriageway and four lane roadways respectively, while **Figure 8.3.3** provides for the right turn lane situation. Both of these guidelines are suitable for the unsignalised intersection situation.

Where the Traffic Impact Study (and traffic engineering analysis) indicates differently, the findings of the study will guide decisions on access provision and layout. This may also identify the need for attention being given to the downstream situation.



Figures 8.3.2(a) and (b): Left Turn Lane Warrants

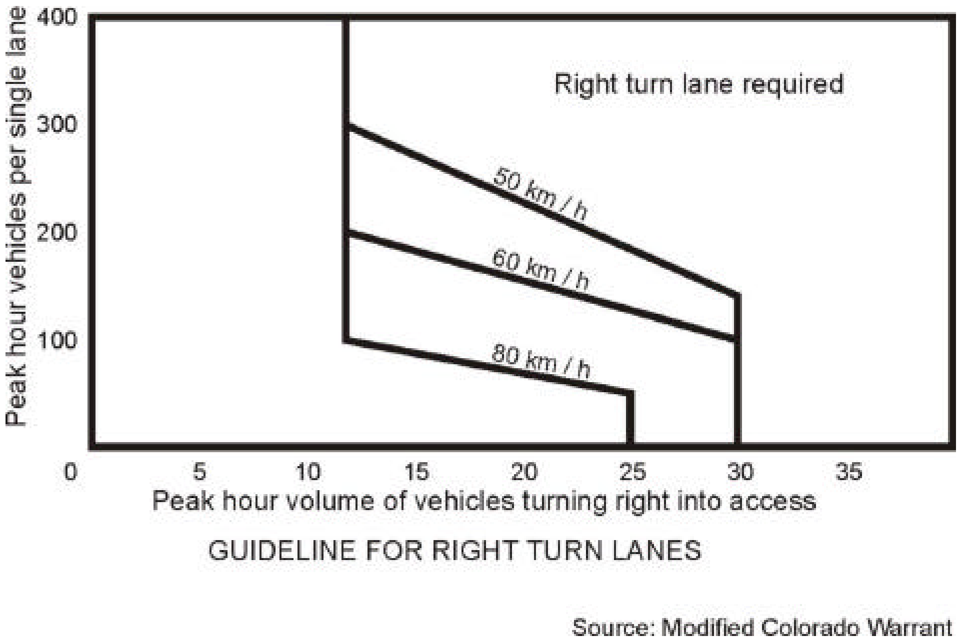


Figure 8.3.3: Right Turn Lane Warrants

8.4 PEDESTRIAN (AND BICYCLE) ACCESS

The integrated land use / transport planning process and site development schemes must include the planning for pedestrians (and bicycle) movement, particularly so where such movement may access or cross a high order arterial. The differential speed between vehicle and pedestrian is such that the pedestrian is at risk in most situations.

On all high order arterials (freeways, expressways and primary arterials) the use of grade separated facilities is either required or desirable. Where these do not exist every effort should be made to orientate pedestrian movement towards traffic signalised at-grade crossing locations.

An important consideration on all roads is the optimal location of bus / minibus taxi stops in the vicinity of normally spaced intersections. Not only does this benefit the user through improved accessibility, but provides spacings between stops, which are sympathetic to bus operations. This is illustrated in **Figure 8.4(a)**.

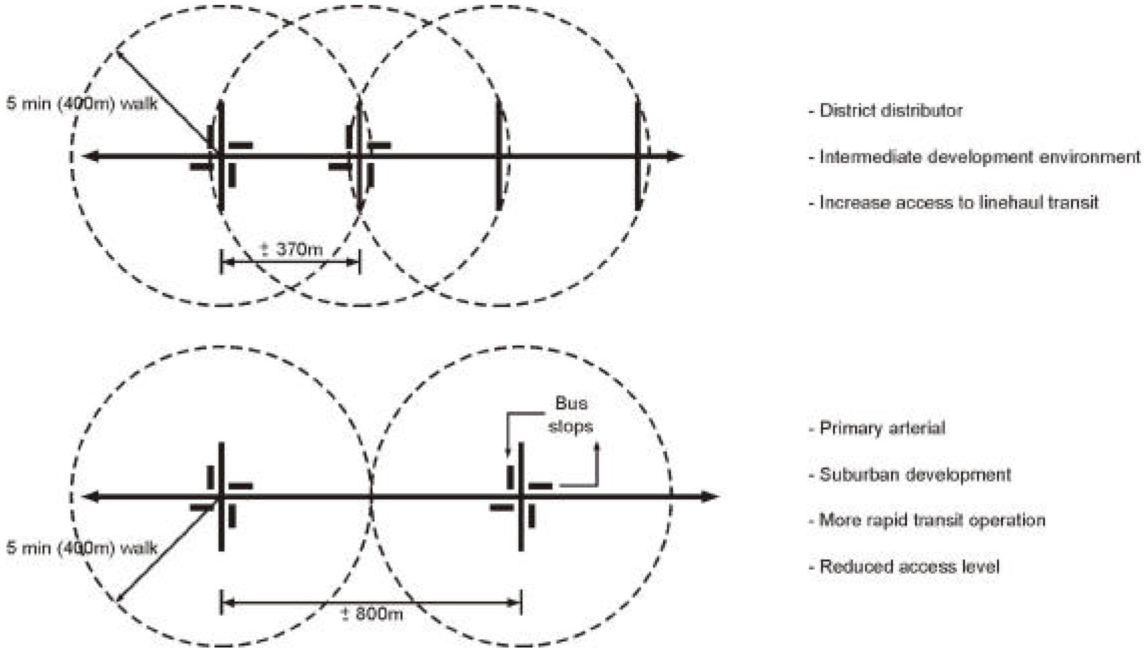


Figure 8.4(a): Walkable Catchment to Bus Operations

In addition pedestrians prefer short walk distances between either car parks or transit stops. This has a direct impact on the positioning of site activities. [Refer **Figure 8.4(b)**].

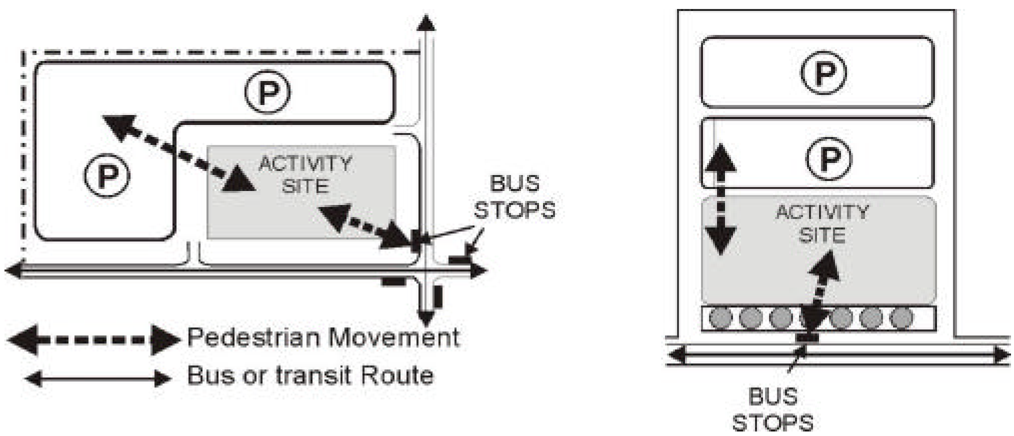


Figure 8.4(b): Preferred site layout to support Public Transport (Transit)

8.5 PETROL SERVICE STATIONS AND DASC'S

For the purpose of access control, petrol service stations are considered `no different from other convenience type retail or commercial enterprises which facilitate drive in service. Drive in fast food outlets, banks and other short turnaround time enterprises such as cafes all offer services to passerby vehicle occupants.

Although in the past, special access standards were developed for petrol stations; these guidelines do not provide any special recognition of one land use type over that of another. Traffic activity is the only determinant for differentiating between the access tables for low, high and equivalent side street traffic driveways.

As a result many corner sites favoured for service stations do not comply with the driveway spacing requirements. As with any other development the primary full (two-way) access to a service station on a primary arterial or expressway must be by way of an intersection at the normal spacings, to obviate undesirable U-turns (Table 6.5.1).

Consideration will be given to additional "left in" and/or "left out" driveway access, where appropriate motivation has been provided, and is in accordance with Tables 6.5.2, 3(a), 3(b) or 4 (whichever is applicable).

The above is much in keeping with the Policy on Public Garages (February 1978) as appropriate to urban areas. While the 'regulation relating to public garages', Provincial Notice 871/1973 and Section 85 of Provincial Notice 4649/1990, have relevance, all applications for rezonings will be dealt with on the basis of the access guidelines.

On rural roads, the need for public garages with a pertinent rest room and café / restaurant facilities is recognised as providing an important service to the motorist.

The nature of service stations, particularly when applied to freeways has adapted to changing needs over time. It is well recognised that in order to combat the effects of driver fatigue and drowsiness that it is desirable to locate Direct Access Service Centres (DASC's) at regular intervals on high order arterials in rural and semi-rural environments.

Spacing of Direct Access Service Centres

- In the interests of safety, viability and user convenience, DASC's should be spaced at regular intervals along high order arterials;

- The minimum distance between DASC's should be 50 - 60 kms or 1 hour's travelling distance for heavy truck vehicles, whichever is the furthest;
- The minimum distance between DASC's may, under exceptional circumstances, be reduced to a minimum of 30 km provided the need for such a reduction is well motivated in terms of safety or topographical constraints;
- The distance from adjacent interchanges or intersections shall conform to normal spacing criteria.

Siting of Direct Access Service Centres

- Where possible, DASC's should be located in such a manner so as to facilitate their effective administration and provision of necessary services;
- The location of DASC's should aim to maximise a positive influence on the local economy without replacing, or competing unnecessarily with existing urban facilities;
- Where DASC's are to be located in outlying or rural environments they should be placed as near as possible to existing towns in order to prevent a proliferation of secondary development.

Design of Direct Access Service Centres

- The design need not be a mirror image configuration. DASC's may be staggered or located as separate entities within an appropriate distance of each other on opposite sites of a dual carriage freeway. The mirror image configuration is encouraged where it is intended to provide a grade separated walkway or skyway at some future date. The control of pedestrians wishing to cross the road or vehicles undertaking U-turns where a mirror image configuration is selected, needs special attention;
- Where DASC's are provided on an expressway or primary arterial, they shall be located at standard intersections spacings. Where they are staggered on a single carriageway road, preference should be given to the first facility reached being on the left hand side of the road;
- All buildings shall be located not closer than 50m from the road reserve boundary, in order to minimise the adverse effects of lighting on passing traffic;

- The development of DASC's shall be undertaken in such a manner as to minimise their impact on the visual and natural amenity of the area.

Size of Direct Access Service Centres

- DASC's shall be of sufficient size to accommodate the necessary rest and servicing facilities;
- Sufficient land must be available for the accommodation of truckers and future expansion.

8.6 EMERGENCY SERVICES

In certain instances it may be required to consider the special access needs of ambulances, fire services and police vehicles. The risk of loss of life or damage to property may require that a time advantage be gained through the provision of an exclusive access at a hospital, fire or police station.

Where such an access is required, ***for emergencies only***, and an alternate access has been provided for other use, special motivation will be required illustrating the criteria and traffic control methods to be used.

The provision of specially designed ***holding areas for emergency vehicles*** may be identified through an active arterial incident management programme. Such facilities may be required to park police or tow away vehicles or even equipment until required for an emergency situation. As in most instances, the sites will be accessed under non-emergency conditions, and the likelihood exists that they will periodically be occupied by non-emergency vehicles, it is preferred that the location of such facilities comply with the general spacings appropriate to the road and development environment.

Roadside Emergency Services or SOS telephones - the spacing of these is often dependent on financial considerations and a preference to locate the telephones at reasonable walking distances (say 800m). Care should be taken to locate such facilities beyond the stopping sight distances required before and after an access. Attention should also be given to ensuring that the distance between road traffic signs, as required in the SARTSM, are adhered to.

8.7 LAYBYES, REST AREAS AND FARM STALLS

Laybyes and rest areas should be provided at regular intervals on the rural high order arterial network (expressways and primary arterials), thereby creating adequate opportunity for drivers to park off the roadway in a safe manner. The provision of these facilities reduces the risk of accidents due to driver fatigue.

Laybyes and rest areas can serve a number of additional functions, as they can be a suitable location to provide drivers with tourist-related information and, in some instances, ablution facilities. Attention to the appropriate signing of these facilities is strongly recommended.

Laybyes - are roadside parking facilities constructed adjacent to the carriageway within the statutory or normal road reserve width. Where traffic on the through road exceeds some 5 000 vehicles per day, the laybye should be separated from the through carriageway by a 4m (minimum) wide verge. For roads with lower traffic volumes, the laybyes can be located outside the road shoulder. The spacing between laybyes should be 5km to 10km. Laybyes may be located at a distance of not less than 500m following a nearby intersection.

Rest Areas - are roadside parking areas of a higher standard, which requires widening of the road reserve. These should be located at intervals that are similar to those of direct access service centres. Where the demand is identified, toilet facilities should be provided. Location of suitable sites for laybyes and rest areas should be determined as part of the arterial management planning for the road. The geometric criteria for these facilities are dealt with elsewhere.

Farm Stalls - as with any other roadside land use, farm stalls are considered to be traffic generators and may be provided access as low or high volume driveways or equivalent side streets. In other words, where there is a desire to locate a farm stall at a farm access, this may be permitted provided the farm access conforms to the appropriate intersection spacings. Access to the farm stall is obtained from the farm access.

8.8 PARKING PROVISION

Associated with the management of the road and the provision of an access is the issue of parking. In general terms, the approach adopted is that *off-street parking is preferred in order to maximise operational and safety efficiencies on the arterial.*

In addition, *off-street parking is to be provided and laid out in a manner, which facilitates easy access and avoids back-up into the street system.*

It is recognised that on-street parking is desired in many circumstances. However, this has been shown to reduce road capacity by some 30% and adds considerably to the accident risks due to the reduction in available stopping sight distance. The risk of pedestrians, particularly children, emerging from between parked vehicles is a concern.

Off-Street Parking Ratios

Parking ratios are specified either in terms of

- a local authority's town planning or zoning scheme; or by
- a road authority as a condition imposed on a rezoning, land sub-division or access application in terms of road legislation.

The latter is generally based on guidelines developed by the National Department of Transport (NDoT) (refer to **Table 8.8.2**) derived from a limited number of surveys of parking demands. On the other hand, local authority standards have in most cases, been derived without appropriate investigation and have been adopted by successive authorities. Both approaches display statistical weaknesses and need to be treated with circumspection.

A preferred approach is that within the context of an integrated land use / transportation plan, the parking policies / ratios are derived as relevant to the study area, and that these be specified on a zonal and land use basis.

On-Site Circulation, Parking Layout and Access Throat Length

Irrespective of the size of a land use development, the efficiency of vehicular entry to a site and the internal circulation pattern and parking layout are important considerations. If poorly designed and managed, it can adversely impact on the adjacent road system and contribute to delays and collision situations. The throat length refers to the manoeuvring distance available from the road between conflict areas as is illustrated in **Figure 8.8**.

The design of a permitted access must be seen in the context of the internal traffic circulation and parking layout. All elements must be properly engineered using accepted guidelines.

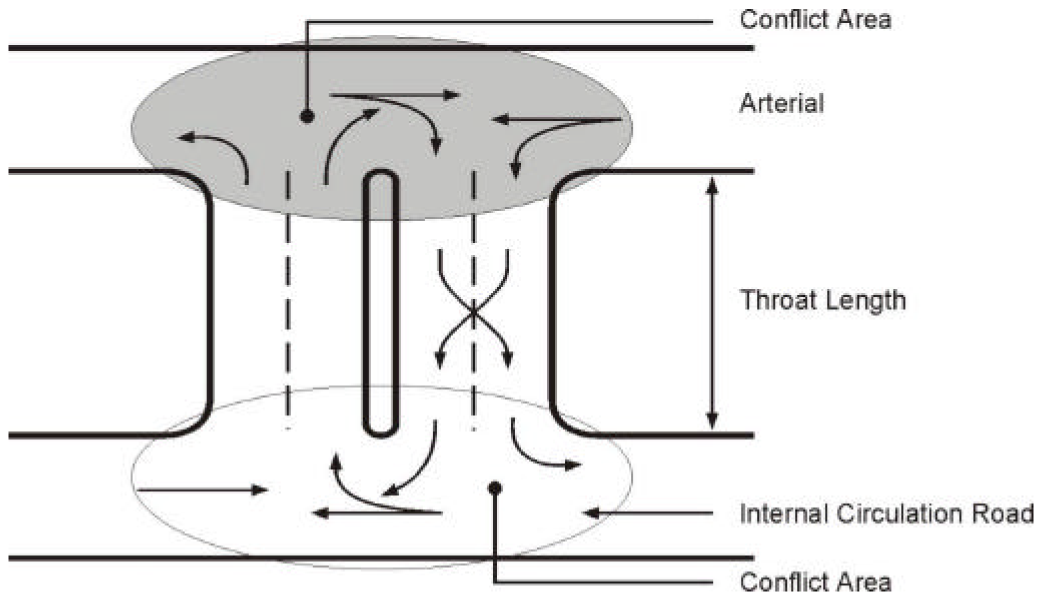


Figure 8.8: Throat Length

Shared Parking

Where more than one land use share a common parking area it may be possible to reduce the amount of parking that would have been required to serve the independent uses. This is because the peak parking demand periods for the various land uses differ.

For a developer to utilise this concept it has to be agreed that the parking areas are indeed common: once the development has been constructed common bays cannot be reallocated to selective uses.

Table 8.8.1 below shows the hourly distribution of parking demand for common land uses. The data is based on two overseas reports, but has been subjectively amended to take cognisance of local conditions.

Table 8.8.1: Hourly Distribution of Parking Demands (percentage of peak demand for parking bays)

Time	LAND USE		
	Office (%)	Retail (%)	Residential (%)
06:00	-	-	100
07:00	20	5	90
08:00	60	25	80
09:00	90	40	60
10:00	100	65	40
11:00	100	95	30
12:00	90	100	30
13:00	90	100	40
14:00	90	100	40
15:00	100	90	30
16:00	75	70	40
17:00	50	35	75
18:00	20	5	90
19:00	15	-	95
20:00	10	-	100
21:00	5	-	100
22:00	-	-	100

Notes:
Developers of mixed land uses may utilise the table to motivate a reduction in the provision of parking bays. The technique entails:

1. Determining the number of parking bays required for individual land uses.
2. For each land use determine the hourly parking demand by applying the factors shown in **Table 8.8.2**.
3. For the combined land uses sum the individual hourly parking demands and identify the hour with maximum total parking demand.
4. Provide bays to satisfy the maximum total parking demand.

Parking to Promote Public Transport

Besides the fact that the provision of parking space is a costly exercise, the availability and the rental charge of a parking space is a key element in the decision to access a particular destination by private vehicle. In other words, a lowering of the provision of parking or increase in cost thereof can be used to encourage the use of public transport.

Table 8.8.2 provides a set of off-street parking indices which can be considered when developing the integrated development plan / integrated transport plan. The adopted indices will be respected when the authorities show evidence that the plan has been approved and where the town planning scheme has adopted the changes.

TABLE 8.8.2: OFF-STREET PARKING INDICES

LAND US E	N DoT *	NORMAL **	PT1 ZONES	PT2 ZONES
Dwelling house or group dwelling	1,0 spaces/unit (1 room) 1,0 space/unit (2 rooms) 1,25 spaces/unit (3 rooms) 1,5 spaces/unit (4 rooms) 0,5 additional/unit for visitors	2 bays/dwelling	1 bay/dwelling	1 bay/dwelling
Flats (including informal settlement which occurs in public transport zones)		1,25 bays/unit plus 0,25 bays/unit for visitors	1 bay per unit plus 0,25 bays per unit for visitors	0,5 bays per unit plus 0,25 for visitors
Additional dwelling		1 additional bay	Nil	Nil
Residential hotels, Guest houses, etc	0,6 spaces/habitable room	3 bays per 4 bedrooms	2 bays per 4 bedrooms	1 bay per 4 bedrooms
Licenced hotels and motels	1 space/habitable room plus 10/100m² PAA	1 per bedroom plus 20 bays	0,75 per bedroom	0,5 per bedroom plus 5
Old age homes, orphanages, etc	0,3 spaces/habitable room	1 per 2 bedrooms	1 per 2 bedrooms	1 per 2 bedrooms
Hospitals (small private clinics and general)	1 space/bed	1 per bed	1 per bed	1 per bed
Medical consulting rooms	6 spaces/100m² GLA	4 per consulting room	4 per consulting room	3 per consulting room
Single shops	6 spaces/100m² GLA	4 per 100m² GLA	2 per 100m² GLA	0-1 per 100m² GLA
Shopping centre	5 - 7 spaces/100m² GLA	6 per 100m² GLA	4 per 100m² GLA	0-2 per 100m² GLA
Offices, General Banks, etc	2,5 spaces/100m² GLA 4 spaces/100m² GLA	4 per 100m² GLA	2 per 100m² GLA	0-1 per 100m² GLA
Industrial	1 space/100m² GLA	4 per 100m² GLA	3 per 100m² GLA	1,5 per 100m² GLA
Service Station / Public Garages	4 spaces/working bay plus 2 spaces/100m² trading area	4 bays per repair bay. Minimum 8 bays	As normal	As normal
Place of Assembly / Worship	1 space/7 seats	1 bay per 8 seats	1 bay per 10 seats	1 bay 15 seats
Schools	1 space / classroom or office	1 per classroom	2 per 3 classrooms	1 per 2 classrooms
Colleges, Universities, Technikons	0,25 to 0,4 spaces/student	1 per classroom plus 1 per 6 students	2 per 3 classroom plus 1 per 10 students	1 per 2 classrooms plus 1 per 20 students
Restaurant		1 per 25m² GLA	0-1 per 25m² GLA	0-1 per 25m² GLA
Recreation, Sport and Entertainment	0,1 to 0,25 spaces/seat ,2 to 20 spaces/100m² GLA	400m² GLA	-	-

* *Refer* N DoT PG 3/85 - Nov 1985   ** Standards generally applied by local authorities

NOTES ON OFF-STREET PARKING INDICES

1. * 'N DoT' Parking Standards PG 3/85 November 1985 are default values accepted by PAWC.
2. ** 'Normal' parking ratios are based on a survey of local authority Town Planning Scheme requirements for areas where public transport is not being promoted.
3. 'Public Transport Zones' (PT1 Zones) refer to sites in areas where the use of public transport is to be promoted but where the provision of public transport is currently considered to be inadequate.
4. 'Public Transport Zones' (PT2 Zones) refer to sites in areas where the use of public transport is actively promoted and the provision of public transport is good.
5. Zones that are initially determined PT1 may be upgraded to PT2 once the provision of public transport is deemed to be adequate.
6. Developers should contact the relevant local authority to determine whether a site falls into a public transport zone.
7. Local Authorities should resolve whether the parking indices listed should be regarded as appropriate and take steps to incorporate them in the TP Scheme.

On-Street Parking

As stated earlier, on-street parking is generally not preferred. **Table 8.8.3** provides an indication of where such parking may be tolerated.

Table 8.8.3: On-Street Parking

Development Environment	Road Categories				
	High Order Arterials		Distributors		
	Freeway	Expressway	Primary	District	Local
Urban	ZONE 1	ZONE 1	ZONE 2	ZONE 2	ZONE 3
Intermediate	ZONE 1	ZONE 1	ZONE 2	ZONE 2	ZONE 3
Suburban	ZONE 1	ZONE 1	ZONE 1	ZONE 2	ZONE 3
Semi-Rural	ZONE 1	ZONE 1	ZONE 1	ZONE 2	ZONE 3
Rural	ZONE 1	ZONE 1	ZONE 1	ZONE 2	ZONE 3

Notes: **Zone 1** : On-Street parking not permitted

Zone 2 : On-Street parking tolerated, but should be avoided where

< improved arterial efficiency is required;
< sufficient off-street parking exists;
< road safety is a concern;
< a priority bus lane is provided;
< a bicycle lane is present.

Zone 3 : On-street parking generally permitted.

GLOSSARY OF USEFUL TERMS

GLOSSARY OF USEFUL TERMS

Access: A driveway or side street connection to a main road. Good access in planning terms is defined as being able to reach a wide range of activities, persons, resources, opportunities and information with the least effort and cost.

Accessibility: In transportation terms accessibility refers to the ability to reach a destination, to stop and alight from a vehicle and to conduct desired transactions. It is the proximity and ease of physical entry to places of work, recreation, education, etc. Refer to **Section 2.3**.

Activity Corridor: An activity corridor is a band of high-density development concentrated along a public transportation route where residential, commercial, industrial and recreational activities occur in close proximity. Social, economic and environmental criteria are important measures of an activity corridor's performance.

Activity Spine: The central road of the activity corridor which carries the major road-based public transport and consequently provides the preferred locations for businesses and community facilities as well as high density housing.

Adaptability: The ability of the urban system to accommodate and respond to change in land uses over time.

Affordability: The ability to purchase a good or service on a sustained basis without compromising other demands on financial resources (for example, public transport charges). Affordability also refers to the ability of the public sector to provide social facilities and services on an ongoing basis within budget limits.

Balance: A state of constructive tension between two or more elements of a system (eg development vs conservation) that enhances the positive features and strengths of the overall system.

Closed Township Layout: Describes a township layout with restricted access opportunities to the higher order road system.

Compaction: This often refers to a process of consolidating and improving the use of space within the urban area through a process of increasing its intensity of use and density.

Containment: The concept of limiting sprawling development on the urban periphery and which is linked to the strategy for intensifying and compacting the existing urban areas.

Decentralisation: The dispersal or deconcentration of government powers from the national level to lower levels of government. It also refers to a strategy aimed at reducing the "pull" of the larger metropolitan areas through incentives for business to locate outside them.

Development: A broad term, which refers to those actions taken by individuals, communities or government, aimed at improving quality of life. Examples are the construction of housing, the provision of infrastructure such as roads and sewers, setting up businesses and establishing community facilities such as schools and hospitals. Measures of development include not only Gross National or Geographic Product, but also reducing levels of poverty, falling unemployment, falling rates of child mortality, and so on.

District Distributor / Integrator / Collector : Refer **Section 4.7 on page 34**.

Dormitory Suburbs: The single use or mono-functional suburbs / townships surrounding towns and cities. Virtually the only functions permitted or in existence in dormitory suburbs are housing related.

Driveway: Access way to property or development.

Effectiveness: The degree to which actions focus on and contribute to achieving a desired result in the best way possible.

Efficiency: The most economical and viable means of achieving a desired result.

Equity: The fair distribution of resources and access to resources enabling people to take advantage of them taking into account any disadvantages they may experience.

Equivalent Side Street: A driveway, which can compare to a public street (for access management purposes).

Expressways: Refer **Section 4.7** on page 34.

Freeways: Refer **Section 4.7** on page 34.

Greenfield Development: Urban development on unserviced vacant open land, which until now has been used for agriculture or other non-urban use.

Infill: The development of vacant or under-utilised land within the existing urban area - usually for well-located affordable housing.

Integrated Development: A process of combining sectoral or isolated actions (that would otherwise be inefficient) into a co-ordinated initiative aimed at improving the use of scarce resources and investment effectiveness.

Integrated Development Plan (IDP): A plan required in terms of the Local Government Transition Plan (Act 97 of 1996), which aims at ensuring integrated and sustainable development.

Integrated Transport Plan (ITP): A plan formulated by a transport authority, core city or municipality in accordance with the National Land Transport Transition Bill 20445 dated 10 September 1999 relating to the regulation, provision and management of transport infrastructure and services consistent with National or Provincial transport policy taking due cognisance of the land use plan.

Intensification of Development: The development within the existing built urban areas, which aims to increase densities and improve the quality of the city, eg urban infill developments.

Land Development Objective (LDO): A development plan required in terms of the Development Facilitation Act 1995 (Act 67 of 1995). This is not relevant to the Western Cape where provincial legislation provides for a similar process.

Land Use: This refers to the actual or permitted activities on a defined piece of land such as residential, commercial, industrial or a mixture of these.

Main Road: Refers to a road of higher order within an urban area, or a road proclaimed as such through legislation.

Mobility: This refers to the ability to move towards a destination without undue hindrance at a certain standard of speed, efficiency and cost-effectiveness. The need for mobility is in support of accessibility.

Open Township Layout: A township layout with multiple access opportunities.

Policy: A general plan of action adopted by National, Provincial and Local Spheres of Government. This is used to guide decision-making and indicates the general intent of the relevant body.

Primary Arterial: See **Section 4.7** page 34.

Principles: A set of values and beliefs that should guide and inform ongoing planning and development.

Protected Transit Route: Any route that is allocated for the use of one type of public transportation mode only, eg a rail reserve, dedicated bus lane, or minibus taxi (MBT) lane.

Sectoral Approach: A process of development whereby investments in one sector are made in isolation without reference or regard to the broader context or other sectors.

Spatial Framework: The organising concept, which is the basis for guiding the location of physical investment and the most appropriate form that investment should take.

Stakeholders: Individuals, organisations and institutions that have an interest (or represent an interest) in development planning. Examples include community-based organisations, political parties, businesses, interest groups and public service officials.

Strategic: A targeted action with the greatest long-term impact, which will bring about (or enable) desired changes.

Strategic Road Network: Describes that part of the road network identified to serve a strategic objective

Sustainable Development: The process of meeting the development needs without compromising or jeopardising the ability of future generations to meet their essential needs, or threatening the viability of systems on which these needs depend. It encompasses that which is technologically appropriate, environmentally responsible, socially acceptable, economically attractive, financially affordable and institutionally manageable.

Threshold: Generally refers to the number of people required to sustain a service or good, for example, the number of people necessary to support a supermarket. It is directly linked to income and accessibility. Many people of low income with good access can provide the necessary thresholds to sustain and support goods and services of a higher order.

Trip Lengths: The distance people travel from a defined origin to a defined destination eg home to work.

Urban Fabric: The "pattern" of urban development taking into account the size of buildings, the nature and amount of space between them and the road network servicing them. Big buildings, with large spaces between them and few roads create a coarse urban fabric.

Urban Form: The physical "look" of the urban area and how the different elements (public space, public buildings, private space and buildings, commercial activity, etc) look and stand in relation to one another. This relates to the height, size and shape of the city and is thus three-dimensional.

Urban Nodes: These are different sized concentrations of economic, commercial, industrial and/or residential development located at points of high accessibility at transport interchanges. They can act as catalysts for new growth and development. Examples of nodes include the Cape Town CBD and the Bellville CBD.

Urban Sprawls: Low-density development (single dwelling units on their own plots) on the periphery of existing urban areas.

Urban Structure: The "layout" of the urban area, ie the spatial geometry or pattern of settlement as created by connecting elements of the urban area such as transport links, parks, squares and other open spaces and how they relate to one another.

Vibrant Environment: An urban environment where there are large concentrations of people and activities, where services and facilities are easily accessible and where they operate in a mutually reinforcing manner to create enabling environments.

This also refers to scenic or visual vibrancy derived from the area's topography, history, aesthetic and cultural diversity.

***Vision*:** A Vision expresses a commonly desired future. It conveys the ideal towards which a collective strives. It is an idealised picture of how things could be.

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