South Africa

COTO

Committee of Transport Officials

TRH 26

South African Road Classification and Access Management Manual

Version 1.0

August 2012

Committee of Transport Officials

TECHNICAL RECOMMENDATIONS
FOR HIGHWAYS

TRH 26

South African Road Classification and Access Management Manual

Version 1.0
August 2012

Committee of Transport Officials

Compiled under auspices of the:

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Technical Recommendations for Highways:

The Technical Recommendations for Highways consists of a series of publications that describe recommended practice for various aspects related to highway engineering. The documents are based on South African research and experience and have the support and approval of the Committee of Transport Officials (COTO). The documents are primarily aimed at ensuring uniform practice throughout South Africa.

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Synopsis:

This manual provides guidance to National, Provincial and Municipal spheres of government on the functional classification of roads and the methodology according to which such classification must be undertaken. It also gives guidance on how a road must be managed in order to function effectively in accordance with its classification.

This manual establishes a uniform and integrated classification system for the country, which will underpin and inform the planning, development and management of roads. It includes the following important aspects:

- The benefits of functional road classification and access management;
- The functional classification system according to which roads are classified;
- The methodology according to which such classification must be undertaken;
- Management requirements (access management) to ensure that the various authorities' roads can function as intended; and
- Retrofit measures that can be implemented in situations where roads are not serving their intended function.

In summary, this manual provides detailed descriptions, explanations and methodologies to determine the functional classification of a road as well as manage accesses in the road system.

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Preface

This Manual is the official requirement for the *road classification and access management* of the South African road network. It provides guidance to National, Provincial and Municipal spheres of government on the functional classification of roads and the methodology according to which such classification must be undertaken. It also gives guidance to how roads must be managed in order to function effectively in accordance with their classification.

The document builds and expands on the classification system of the *Road Infrastructure Strategic Framework for South Africa* (RISFSA) of the South African Department of Transport (DOT, 2006) and supersedes both the draft *National Guidelines for Road Access Management in South Africa* (COTO, 2005) and the *Manual for the Redefinition of the South African Road Network* (DOT, 2008).

Road authorities in South Africa have an obligation to plan, design, construct and maintain the road network, to protect the public investment in the road infrastructure, to ensure the continued functionality of the transportation system and to promote the safety of traffic on the road network. Authorities also have the obligation to provide a reliable, effective, efficient and integrated transport system that supports the sustainable economic and social development of the country.

This Manual provides guidance on the functional classification and access management of roads. It establishes a uniform and integrated classification system for the country, which will underpin and inform the planning, development and management of roads. It includes the following important aspects:

- The benefits of functional road classification and access management;
- The functional classification system according to which roads are classified;
- The methodology according to which such classification must be undertaken;
- Management requirements (access management) to ensure that the various authorities' roads can function as intended; and
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In summary, this Manual provides detailed descriptions, explanations and methodologies to determine the functional classification of a road as well as manage accesses in the road system.

Definitions

For the purposes of this manual certain key words and concepts are uniquely defined. For example “access”, “accessibility”, “collector”, “distributor”, “urban” and “rural” all have specific meanings that are important in order to interpret this manual correctly.

Access. Any public or private road, ramp, driveway, intersection or path which crosses or is connected to a public road.

> **Egress.** An access which is out only (from a property to a public road).
> **Ingress.** An access which is in only (to a property from a public road).

Accessibility. The ease with which a destination can be reached. A concept more closely related to mobility than to access.

Access management. The equitable provision of a safe and efficient road network through the systematic control of access on mobility roads and mobility on access streets.

Access street. A street where the access function, and the activities associated with access, predominate over movement requirements (see activity street).

Activity. Activity in terms of this document includes the activities required for human economic and social interaction. The provision of access to land for living, working, trade, manufacture, provision of services, education, sport, health or recreation and which results in a combination of movements or activities that take place within a road reserve and adjacent environment. These activities could include traffic movements both along and across the road, turning in and out of driveways, public transport (bus/taxi) movements and stops, parking, stopping, loading, pedestrians and persons with disabilities, walking, running, cycling, skateboarding, sidewalk cafes, window shopping, hawking, and even playing in the street. The degree of access to adjacent land and the land use itself generally determines the level of activity in the road reserve.

Activity node. Places where public and private investment and activities tend to concentrate. In addition to the activities mentioned above, a wide range of economic and social activities, as well as mixed use developments, occur within such nodes.

Activity corridor. A linear zone of development, up to 2 km wide, connecting large activity nodes, flanking a public transport and freight route (spine), and containing a high concentration of people and mixed land uses.

Activity spine. A road providing direct or indirect access to high intensity land uses in its near vicinity. A major carrier of various modes of traffic, especially freight and public transport vehicles.

Activity/Access street (for access management purposes). Any Class 4, 5 or 6 collector, local and pedestrian street where the access function predominates and mobility is restricted.

Activity street (for town planning purposes). A “local” street with high levels of land use intensity but lower levels of movement than on an activity spine, but attracting enough trade to provide business opportunities.

Arterial. Any Class 1, 2 or 3 vehicle priority, access managed, mobility route whose major function is to provide for movement of person and goods vehicles between cities, towns or urban districts with as few restrictions as possible.

Auxiliary lane. Right or left turning lane added locally to improve capacity and/or safety.

Bypass. A high standard mobility road with limited access designed to carry traffic which does not have a destination in the urban area which is bypassed. These roads are treated as rural roads for the purposes of functional classification and access management.

CBD. Central Business District, the major commercial activity and employment destination (activity node) in the town or city. A metropolitan area may have more than one such district.

Class. All public roads and paths in the country must be allocated into one of six functional classes, numbered for ease of reference. Each class has a unique function to fulfil.

Collector. A road which collects (or distributes) traffic in a local district. Collectors should not carry traffic passing through the district with destinations elsewhere but can serve as activity spines and streets. Although all roads have a "collection function", the term "collector" is reserved for Class 4 roads.

Distributor. Long distance arterials which distribute traffic over wide areas. Although all roads have a "distribution function", the term "distributor" is reserved for Class 1 to 3 roads and is often preferred to the word arterial in rural areas.

District (urban). A collection of suburbs with similar characteristics (e.g. residential district, business district).

District (rural). A uniform management unit of rural land (e.g. farming district).

Equity. The provision of an equal opportunity to all road users and developers wishing to use public roads and infrastructure. It implies refusing access on mobility roads to individual developments where this would be to the detriment of the majority of road users or unfair to other developments.

Expressway. Highway with no stops for through traffic. Intersections are stop controlled on side road or grade separated. Expressway refers to the design and access control standard of a road.

Freeway. Physically divided, grade separated, dual roadway with access via ramps; designated as such in terms of the National Road Traffic Act.

Functional classification. The classification of roads and streets according to their primary function, i.e. mobility/movement or access/activity, subdivided into Classes according to the character of service they are intended to render.

Functional relationship. The relationship between functional road classes is such that diverse classes should not be connected. It is preferable for each road class to connect to an adjacent road class and should not connect to a road class more than two numbers different.

Highway. High speed (70 to 80 km/h urban, 80 to 120 km/h rural), continuous, vehicle priority route. In urban areas they are characterized by widely spaced co-ordinated traffic signals. Can have grade separated, priority or roundabout intersections but these are less common.

Intersection. The point at which two public roads join or cross (a specific type of access).

Local road/street. A Class 5 road (rural) or street (urban) carrying traffic with origins or destinations in the immediate (local) area with the main purpose of giving access to individual properties.

Main road. Mobility road capable of safely carrying traffic at speeds of around 70 km/h.

Marginal access. Access from and to a road from one side only and in one direction only. Also known as a left-in / left-out access. In a one-way street configuration it could also comprise right-in / right-out access.

Mobility. The ability to reach a destination with a minimum of delay. A fundamental requirement for accessibility.

Mobility road. A road specifically designed and protected to promote vehicle movement. Priority is given to through traffic movements. Most of the activities allowed on access/activity streets are not permitted on mobility roads.

Motorway. Freeway; the English as opposed to American term for a physically divided, dual roadway with access via grade separated interchange ramps.

Partial access. Left-in / left-out (marginal) access combined with a right turn from the main road. Partial access excludes right turns from the access as well as crossing movements.

Property (private) access. Access, driveway or road from any individual erf or other property to a public road, irrespective of land use or ownership (private or government) of the property.

Quarter Link. A grade separated intersection joined by a ramp in one quarter, with T-intersections on both legs. Left-turn ramps in the other three quarters are common.

Reach of connectivity. An indication of the length of travel that can be accommodated on a particular route.

Road. A wide way between places. Roads are generally but not exclusively associated with the mobility function (see street).

Rural area. Any area not defined as an Urban Area. Typically an area of sparse development, mainly given over to nature or farming activities.

Rural roads. Any roads located in a rural area and include Through-ways and Bypasses passing through urban areas.

Rural settlements. Informal and formal rural developments one hectare in size or smaller must be treated as urban areas for the purposes of this Road Classification and Access Management Manual.

Street. A town or village “road” typically with access to buildings on one or both sides. A street is exclusively associated with the access/activity function (see road).

Through-way. Similar to Bypass, but one which passes through rather than around an urban area. Through-ways do not provide convenient access for local traffic and have interchanges spaced according to rural road standards. Although located in an urban area, these roads are treated as rural roads for the purposes of this manual.

Urban area. For the purposes of this manual, an urban area is an area which has been subdivided into erven, whether formal or informal. It includes formal and informal rural settlements of one hectare or less.

Urban road. Urban roads are any roads located in an urban area, excluding Through-ways and Bypasses.

Walkway. Areas and streets exclusively for pedestrians or where non-motorized traffic and pedestrians have priority.

1 Introduction

1.1 Background

This Manual is the official requirement for the functional classification and management of the South African road network. It provides National, Provincial and Municipal spheres of government with the requirements for the classification of roads and the methodology according to which such classification must be undertaken. It also determines how roads must be managed in order to function effectively in accordance with their classification.

The document builds and expands on the *Road Infrastructure Strategic Framework for South Africa (RISFSA)* of the South African Department of Transport (DOT, 2006) and supersedes the draft *National Guidelines for Road Access Management in South Africa* (COTO, 2005) as well as the *Manual for the Redefinition of the South African Road Network* (DOT, 2008).

According to RISFSA (DOT, 2006), the classification and management of the road network is a fundamental component for the planning and development of road infrastructure in the country in order to optimise efficiency and effectiveness in the delivery of roads. The road network is considered to be the heartbeat of development, because it performs the basic yet critical function of providing the lifeblood of access and mobility for the execution of economic and social activities.

Roads play a significant role in economic development. Effective infrastructure is considered to be a key precondition for national economic growth. By investing in such infrastructure, the cost of transport and communications can be reduced, thereby facilitating trade and creating wealth. Roads are known to be an enabler of growth and a guarantor of national integration, both linking internally and externally with the global economy (DOT, 2006 (RISFSA)). The functional classification system is precisely aimed at ensuring that the road infrastructure effectively serves these needs through providing the required levels of mobility and access. Appropriate access management assures that roads can indeed play their role in the country's economy.

Road authorities in South Africa have an obligation to plan, design, construct and maintain the road network, to protect the public investment in the road infrastructure, to ensure the continued functionality of the transportation system and to promote the safety of traffic on the road network. Authorities also have the obligation to provide a reliable, effective, efficient and integrated transport system that supports the sustainable economic and social development of the country.

The purpose of this Manual is to provide requirements for the functional classification and access management of roads. It also refers to the issue of administrative jurisdiction and responsibility. Broad guidance is provided on such issues as the road numbering systems and the relationship between such systems and the road classification system. However, the functional classification system does not replace other systems such as the administrative, technical and road safety systems that are implemented by road authorities.

1.2 Overview of the Manual

This Manual provides guidance to all road authorities on the following:

a) The benefits of functional road classification and access management.
b) The functional classification system according to which roads are classified;
c) The methodology according to which such classification must be undertaken;
d) Management requirements (access management) to ensure that the roads can function as intended;
e) The methodology of applying access management; and
f) Retrofit measures that can be implemented in situations where roads are not serving their intended function.

The classification system is based on the six functional classes of the *Road Infrastructure Strategic Framework for South Africa* (RISFSA) (DOT, 2006) as well as the *National Guidelines for Road Access Management in South Africa* (COTO, 2005). This system acknowledges that individual roads and streets cannot serve all travel functions, but that travelling is characterised by movement through networks with different functions along the route.

Once roads have been functionally classified, it is then critical that they are managed to ensure that they can actually perform their function. This is the purpose of road access management. The Manual therefore also contains guidance on how such access management must be implemented in a comprehensive and coherent fashion, including retrofit measures that must be implemented in cases where roads are no longer serving their intended function due to historical factors.

In summary, this Manual provides detailed descriptions, explanations and methodologies to determine as well as manage a functional road network.

2 Benefits of Road Classification And Access Management

2.1 Introduction

A safe and efficient road network is an essential enabler of *sustainable development* in both urban and rural areas in this country. Economic growth and development requires the support of an effective and efficient public, private and freight transport system enabled by the road network. Road Classification and Access Management is the key component in providing a safe and pleasant living and working environment for South Africa's citizens, whilst at the same time meeting the movement needs of the broader economy.

This chapter deals with the following benefits of road classification and access management:

- Improved capacity and traffic flow (more efficient private and public transport)
- Improved safety (for all road users, whether vehicles, cyclists or pedestrians)
- Efficient use of scarce resources (less road construction needed)
- Equality for all users
- Planning certainty for developers
- Integrated land use and transport
- Social benefits
- Environmental quality
- Economic benefits

2.2 Improved capacity and traffic flow

A functional mobility road network, effectively managed, improves capacity and traffic flow, thus reducing travel time and travel cost to the road user. Each additional access located on a road reduces the traffic-carrying capability of the road and the efficiency of traffic flow. Management of access thus reduces congestion and improves the utility of the road system, thereby increasing the operational life of the system.

Travel time is significantly increased when there is little or no control of access. Travel time on such roads can increase by 75% or more compared to roads with partial or nearly full control of access (Highway Capacity Manual (TRB, 2000)). Travel speeds are correspondingly higher on access controlled roads.

The installation of non-traversable medians will increase the capacity of a four-lane arterial by about 50%. This has the same effect as widening the arterial from four to six lanes (Stover and Koepke, 2002).

Study after study has shown that properly managed access spacing enables traffic signal co-ordination (synchronization) which reduces delay and congestion by 50% to 75%. This would mean that for the same traffic flow on the same arterial road, the level of service would improve from LOS E to LOS B merely by implementing access management.

2.3 Improved road safety

One of the most important benefits of access management is improved traffic safety. Road accesses and intersections are the elements of the road network at which most collisions occur in urban areas. The same would be true for rural arterials if large numbers of accesses and intersections were provided. The control of accesses on higher speed mobility roads could therefore make a significant contribution to the reduction in collision rates - an objective that is particularly important in a country such as South Africa.

Conversely, large numbers of closely spaced access points are permitted and should even be encouraged on activity streets. Here access management implies deliberate measures to slow and impede through traffic to ensure that speeds are kept low for safety reasons.

The safety benefits of access management have been consistently shown by a number of decades of safety research (TRB, 2003). The following are a sample of the research studies indicating the impact of road access on traffic safety of arterial roads:

- According to AASHTO (2004), full access control is the most significant geometric design factor that can contribute to traffic safety. Roads with full access control consistently experience only 25% to 50% of the accident rates on roadways without access control. As the number of accesses along a road increases, the accident rate also increases. Each additional access per kilometre of road increases the accident rate by approximately 5 percent;
- Gluck et al (1999) reported that accident studies over a number of decades point to the same conclusion - an increase in the number of accesses translates into higher accident rates. The greater the frequency of driveways and streets, the greater the number of accidents. The control of access spacing is one of the most important access management techniques;
- Preston et al (1998) reviewed case studies of access management projects in Minnesota and found an average reduction of about 40% in accident rates. The conclusion of the study is that access management is a legitimate public safety issue;
- Case studies of the safety benefits of access management in the Denver Metropolitan area (Colorado), found that a typical four-lane road with a high level of access control can serve 10,000 more vehicles per day at double the average speed and with a 50% lower accident rate than a similar road with a low level of access control (Public Works, 1995);
- A study undertaken by Gattis (1996) of accidents on three arterial segments in a small city in the United States indicates that the segment with the highest level of access control experienced a 40 percent lower accident rate than the two with lower levels of access control. All three segments had four lanes with median treatment and turning lanes, but had different levels of access management in place;
- Studies in Iowa (Maze et al, 1999) showed that access management can “dramatically” and significantly reduce accident rates. Accident rates were reduced by 50% or more in some locations where access management was implemented.

2.4 Efficient use of scarce resources

It has been shown that a six lane roadway with uncontrolled access would be required to provide the same capacity as an access managed four lane highway (Stover and Koepke, 2002). Access management of arterials can therefore save significant resources by requiring less road construction and by delaying the need for road widening.

In addition to the impact on road capacity, uncontrolled access also leads to impacts on other resources such as fuel consumption, air quality, and damage and injury due to collisions, etc. The cost of such impacts over a period of time can be equivalent to the cost of providing a new road.

The infrastructure savings do not only relate to mobility roads. On activity streets, narrow lanes are not only desirable but a requirement to reduce speeds. As activity streets can have narrower lanes than equivalent mobility roads, construction costs could again be saved. Hence access management reduces the strain on resources on both mobility roads and activity streets.

2.5 More efficient public transport

Access management ensures higher speeds and less congestion on arterials. This same benefit will assist in improving the efficiency of *public transport*. Higher levels of mobility due to road access management reduces time delays resulting from friction between stop-start traffic flows and therefore enhances the punctuality and efficiency of the public transport system. This combination will enable higher density developments.

If this is added to the other form of access management, i.e. mobility management on access/activity streets, which deliberately slows traffic, neighbourhoods will become more pedestrian friendly. Walking is encouraged by providing streets that are made more “liveable” by forcing higher speed through traffic to arterial roads. The combination of higher densities and a greater willingness to walk means that more people can reach public transport stops and stations. This provides greater opportunity for sustainable public transport. Denser developments are therefore supported by more efficient roads carrying more people and more traffic.

2.6 Equality and equity

When a property is given access to an arterial road, the capacity of the arterial is reduced and delay to through traffic is increased; made worse if an unwarranted traffic light is installed. Even if the intersection and signal is paid for by the developer, this is detrimental to the system as a whole, detrimental to the majority of road users and unfair to all other developers who may not have the same opportunity or privilege. What may be to the benefit of an individual developer therefore is often to the detriment of the public as well as other developers, not only in the vicinity but for kilometres downstream.

In the interests of equality and fairness, every development, regardless of size or political influence, should be treated equally. Adopting these road classification and access management guidelines will ensure that no individual development is given access not meeting the required standards.

2.7 Certainty

Roads pre-classified, accompanied by strictly enforced access management, will give planners certainty, in that all the mobility roads will be declared and the allowable intersections and accesses determined before an access application is made. Those applications not meeting the requirements for access will be refused and the official making the ruling will have the backing of the authority's policy and this Manual.

The benefits of certainty and equity to the planning and implementation of projects should not be underestimated.

2.8 Land use and transport integration

Roads must be provided to suit land use and not the other way around. The road network is determined by the land use, and the functional classification makes it clear that it is the size, importance and density of destinations that need to be served that determine the number and class of road required to serve them. Access management provides the means to ensure that the designated roads are able to serve land uses in an appropriate and efficient manner. Land use and transport integration thus means that the hierarchy and protection of the different road Classes appropriate to their function is an integral part of enabling efficient and sustainable land use. It definitely does not mean however that every piece of land should be given full access to any road.

The process of land use and transport integration and the identification of nodes and corridors must therefore be a joint exercise of the town planning and engineering departments. The importance of this Manual, which emphasizes the need to classify and manage roads appropriately in order to support land use, must be accepted by all stakeholders.

A possible concern of access control is that the greater mobility levels and access restrictions could result in less dense townships. This however is unlikely to happen for the following reasons:

- Urban sprawl is caused by, amongst others, the lack of accessibility in the inner city areas (high levels of congestion). The need to move further out is partly related to the congestion typically experienced in such areas;
- The greater efficiency and carrying capacity of access managed routes enables higher densities and consequently more effective public transport. This in turn enables densification policies to be applied;
- Funding for roads is limited. Access management will concentrate funding on upgrading existing infrastructure enabling the demand for denser developments to be met rather than building new roads for outlying developments.

2.9 Social benefits

A significant advantage of access control is that it can contribute to the quality of living in residential neighbourhoods. The public has always been concerned about the impact of traffic upon their neighbourhoods, and has become less tolerant of the noise and general disturbance caused by traffic in their streets. Many persons regard the road reserve as an extension of their residential environment and believe that the road outside their homes should be able to be used without fear of collisions, and even for other activities such as social events and a playing area for children. Road reserves take up a large portion of land and the multi-use of the road reserves represent a more efficient land use, especially in less privileged areas where the streets are the playgrounds.

Managing access in a way that accords with the function of the road will allow acceptable mobility on through routes (arterials) and reduce speeds in residential areas (activity streets). This, together with appropriate design, will reduce if not eliminate intrusion of through traffic into residential areas.

2.10 Environmental quality

Access management benefits the natural environment by ensuring a more effective utilisation of existing resources. Improving the flow of traffic on major roads not only leads to a reduction in vehicle emissions, but also to a reduction in the need for new road construction and road building materials.

Improved transportation also supports higher development densities aimed at curbing urban sprawl, which allows for more open spaces. Traffic congestion, queues, noise and pollution make for unpleasant living and working conditions. Access management helps relieve congestion and reduces “rat running”, therefore contributes greatly to the environmental quality of liveable townships.

2.11 Economic benefits

The *Road Infrastructure Strategic Framework for South Africa* (RISFSA) (DOT, 2006) recognizes that a country’s road network has an important role to play in economic and social activities. An inadequate transport system prevents communities from accessing economic and social opportunities and thus the means to generate income and improve the quality of life. Without adequate transport, communities will remain isolated from economic centres and therefore trapped in the web of poverty.

There is thus a relationship between poverty and the lack of efficient transportation systems. Without efficient transportation, communities are marginalized both economically and socially. Travel then becomes a time consuming task, requiring effort that could have been devoted to more productive activities. Inordinate amounts of household time and energy are consumed in carrying out basic tasks requiring transport.

One of the greatest contributions that a proper functional classification and an appropriate management of access can make to human endeavour is to maintain the economic viability of businesses and communities by balancing mobility and access, i.e. ensuring accessibility.

While some individual developers may believe that they cannot thrive without direct access to the major road network, this must not be allowed if it prejudices the majority of road users. Many authorities may fear that access control and management will scare away development, a fear that is promoted by developers working individually. Various studies, however, have found that this fear is unfounded.

Increased mobility and improved overall accessibility resulting from access management lead to improved competitiveness and an increased rate of economic growth. The reasons for this are described below.

a) Improved accessibility leads to greater access to economic opportunities for both businesses and individuals:

   i) An increased market area from which customers can be drawn because of reduced travel times. If the average speed on roads in an area is 35 km/h, a business is within a 20-minute drive for customers living in a 12 km radius. For an average speed of 50 km/h, however, this distance increases to a 17 km radius, which is equivalent to an area twice as large. These advantages mainly would be obtained at regional shopping centres or office complexes that attract their clientele from a large area, but also apply to smaller developments;

   ii) Better access to a greater number of suppliers, which improves competitiveness and therefore results in greater efficiency and quality of service;

   iii) Increased labour market area for employers;

   iv) Greater job opportunities for job seekers;

b) Accessibility also leads to improved productivity resulting from improved transportation efficiency. Reduced travel times have the following economic advantages:

   i) Lower direct cost of transporting goods;

   ii) Reduced labour costs due to greater productivity;

   iii) Lower transport costs from home to work;

   iv) Fewer warehouses because of the larger area that can be served by a warehouse;

   v) Reduced stockholding due to improved accessibility to suppliers;

   vi) Tighter scheduling which allows the application of “just-in-time” principles. This enables firms to reduce inventory levels and stockholding, releasing working capital for investment in more productive activities;

   vii) Lower transport costs lead to customers having more funds available to spend on consumption activities.

c) Better accessibility realizes increased land values:

   i) Increased land value is a typical benefit of accessibility improvements. The highest values for business properties are always in areas with the greatest accessibility. In most cities in South Africa, land values in central business districts have suffered as accessibility has been restricted by

outlying developments. Investors are often attracted to new areas with good accessibility because of the ease at which suppliers, staff and customers can access a development.

d) Improved accessibility can significantly improve economic viability:

i) One of the alleged disadvantages of Access Management is that it may deprive developments of the opportunity of gaining direct access to high volumes of passing trade. While it is conceded that such direct access may have advantages to an individual development, it reduces accessibility to all other developments and is therefore to the detriment of an area as a whole. Once such an access is allowed, mobility is reduced and other developments become less viable. A single poorly placed access can cause significant delays to a very large number of road users.

ii) A number of studies in the USA have attempted to measure the economic effect of Access Management on businesses. In general those studies have concentrated on retrofitting (closing gaps in median islands to create 800 m (half mile) spacings between intersections). The studies have been countrywide (Williams, 2000), and state-wide, such as Texas (Eisele and Frawley, 2000), Kansas and Florida (Williams, 2000) as well as Iowa (Maze et al, 1999).

iii) The finding was that access management generally does not equate to economic losses, although some business on the affected road may have small disbenefits (1.0% to 2.5%). However, the road improvements often acted as a spur to business to upgrade their operations.

iv) Furthermore, the studies showing disbenefits were localised, concentrating only on the affected properties. No measurement was made in these studies of the benefits to business downstream due to the improvement to their accessibility. This effect is hard to measure, but along with road safety is the reason why the access management upgrading was required in the first place.

3 Road Classification Concepts

3.1 Introduction

The primary purpose or function of a road and street network is to serve the need to travel for all modes of transport, including walking. A road network must therefore connect origins and destinations for all potential users i.e. make it possible for people and goods to go efficiently and safely from any one place to any other.

The basic concept is illustrated in Figure 1 in which lines of travel desire are shown as straight lines connecting origins and destinations. The relative widths of the lines relate to the amount of travel desire while the lengths of the lines indicate the travel distances. The figure applies to rural areas, but the principles of the figure also apply to urban areas. The basic concepts of road classification are the same irrespective of whether an area is rural or urban.

The figure shows the desire lines between nodes ranging from major metropolitan areas or nodes down to individual properties. The relative sizes of the circles indicate relative trip generation or attraction of the nodes. The figure also illustrates the need to provide mobility roads to serve large volumes of travel over long distances between the major nodes (solid lines) while access roads are required to serve smaller nodes and individual properties (dotted lines).

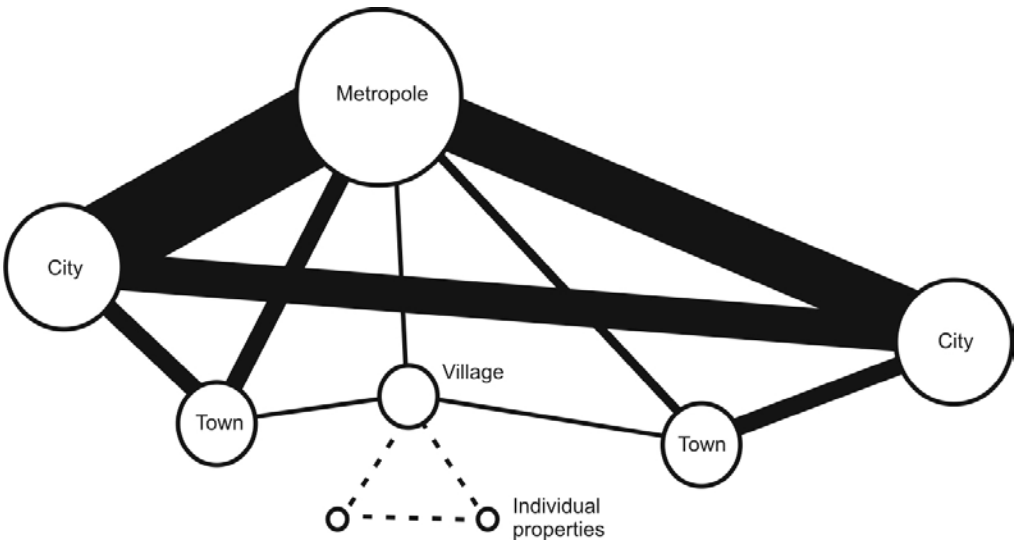


Figure 1 Desire Lines of Travel

3.2 Accessibility

A measure of efficiency of the road network is the level of accessibility it provides. If an area or destination can be easily reached from other parts of the road network, it is accessible. Accessibility gives land commercial value.

The difference between "access" and "accessibility" in the context of road classification is often not well understood. Accessibility defines the ease with which a destination can be reached and is therefore a concept more closely related to mobility rather than to access. An access is the physical connection that allows traffic to enter or cross a public road.

Accessibility is a combination of mobility and convenient access. A level of mobility is required to travel between the major nodes of the country or within a municipality, while convenient access is required to enter or leave individual properties.

AASHTO (2004) uses the term “movement hierarchy” to differentiate between the movement stages of mobility and access. A high level of accessibility can be provided when it is recognised that a trip or journey requires both mobility and access during different stages of a trip. Near to the origin or destination of a trip, a high level of access is required while a high level of mobility is required further away from the start or end of the trip.

High levels of both mobility and access are unfortunately not compatible and cannot be provided in the same road space. Greater numbers of access points impair mobility, and mobility creates safety hazards for both vehicle and pedestrian access users. Hence to safely achieve accessibility, it is necessary to dedicate some parts of the road network primarily to mobility and other parts primarily to access and related activities.

The concept of *functional road classification* is therefore to determine the primary function (mobility or access, and the degree thereof) of each section of the road network. *Access management* is then needed to design and implement measures compatible with this function.

3.3 Mobility and access roads

Mobility is the ease with which traffic can move at relatively high speeds with the minimum of interruptions or delay. Access provides entry to the road network through driveways, intersections or interchanges.

Any access, intersection, or associated activity, even if properly designed, will affect the mobility requirement because the act of turning into or out of a driveway or intersection is a low speed manoeuvre and crossing a road requires interruption or breaks in traffic flow. If not managed, unregulated access results in unsafe travel conditions for both the users of the access and passing traffic.

Mobility roads therefore are higher speed through routes on which mobility is dominant and access and pedestrian crossings are limited to defined and clearly demarcated positions at widely spaced intervals. Mobility roads are the “vehicle-priority” routes in a road network (the *Guidelines for Human Settlement* (DOH, 2000) uses the term “vehicle only roads”).

Access/Activity streets on the other hand cater specifically for land access as well as associated activities. The provision of access for both vehicles and pedestrians from the street to adjacent land and the activities resulting becomes the predominant function. As such care must be taken to keep speeds low for the safety of both pedestrians and turning traffic. These streets are therefore “liveable” places where vehicle and pedestrian traffic are mixed (the *Guidelines for Human Settlement* (DOH, 2000) uses the term “mixed pedestrian and vehicle” streets).

The term access/activity street is used in this manual to indicate that the function of these streets is not only to provide land access, but also to serve various other activities. Land access remains the main function, but provision must also be made for pedestrians, cyclists and other non-motorised modes of transport. Other activities that can also be accommodated may include socializing, walking, running, dog walking and even skateboarding, sports and playing. Similar activities can also occur in rural areas, provided that speeds are restricted.

3.4 Mobility and access functions

If high levels of both mobility and access could be achieved on the same road, there would be no need to classify roads according to function for access management purposes. However, in practice and without exception, increasing the number of accesses reduces operating speed and increases interruptions along a road, which is detrimental to the function of mobility. The activities associated with such accesses further aggravate this disruption.

If fast moving (high mobility) traffic is mixed with high levels of access and pedestrian traffic, unsafe conditions inevitably result. Collisions become a regular occurrence. Due to the relative high speed of mobility routes, these collisions, particularly those involving pedestrians, are serious and often fatal. Having routes which try to serve both functions equally is counterproductive and dangerous.

It is of paramount importance and central to the entire safety and efficiency of the road network therefore that the functions of mobility and access are not confused and not mixed. Clearly high levels of both mobility and access activities on the same road section cannot be allowed.

Hence the need for a *functional road classification* according to which every section of the entire road network must be split into one of two groups, according to whether it will primarily serve a mobility or an access/activity function. By providing a suitable balance between mobility roads and access/activity streets, it is possible to provide a high level of connectivity, while maintaining a high level of road safety and accessibility.

3.5 Earlier functional classification systems

Earlier functional classification systems did not draw a clear distinction between the mobility and access function. Figure 2 was originally produced in "*A Guide for Functional Highway Classification*" nearly fifty years ago (AASHO, 1964) and has been repeated, with various minor modifications, in every report on functional classification ever since. It indicates a continuum of mobility and access functions with no clear guideline as to which should be given priority. In fact, it implies that the two functions can be mixed. This has often resulted in access being allowed on mobility roads, even on arterials, and not only on collector roads as allowed by the diagram.

Later work by Austroads (Brindle, 1987) indicated an option between the two extremes; the mixing of movement and access shown in Figure 3(a) and the total separation of the two functions shown in Figure 3(b). A compromise was later proposed by the same author, shown in Figure 3(c) Separate Functions Model (Brindle, 1996).

The uncompromising principle adopted in this manual, i.e. the strict separation and independence of the mobility and access functions, was earlier emphasized in the draft *National Guidelines for Road Access Management in South Africa* (RAM) (COTO, 2005) reproduced as Figure 4 and Figure 5.

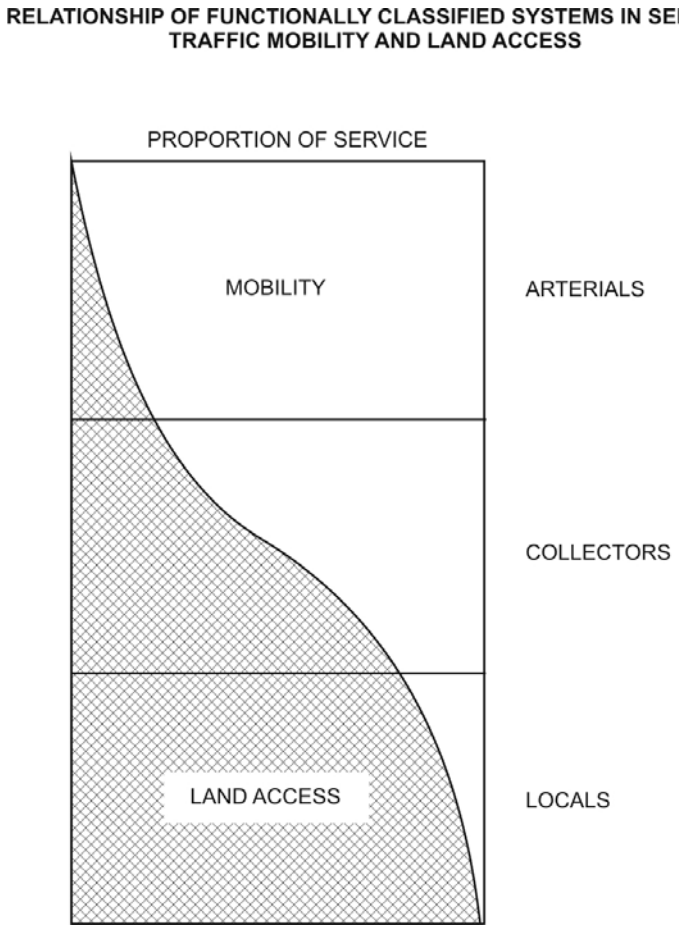
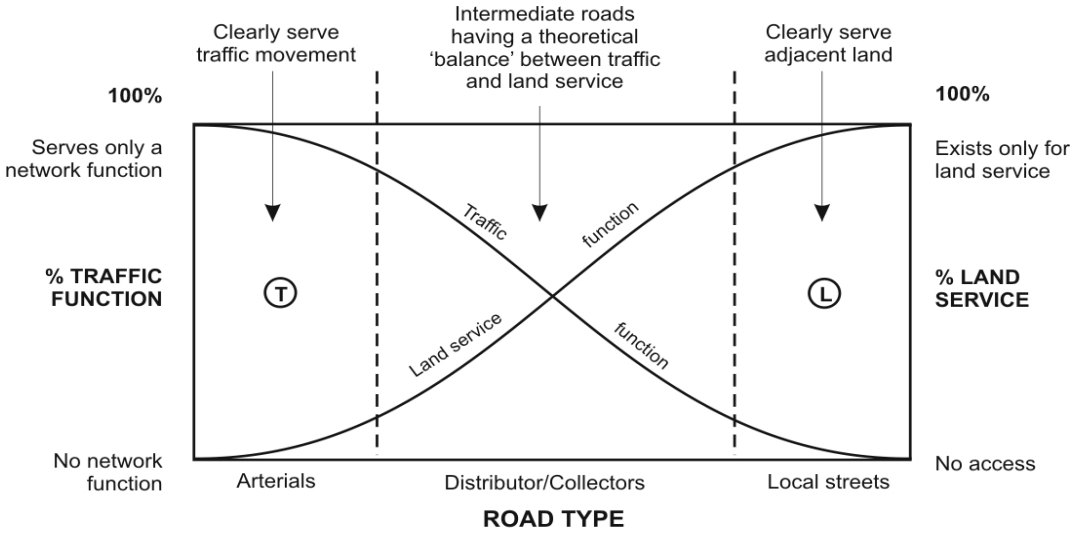
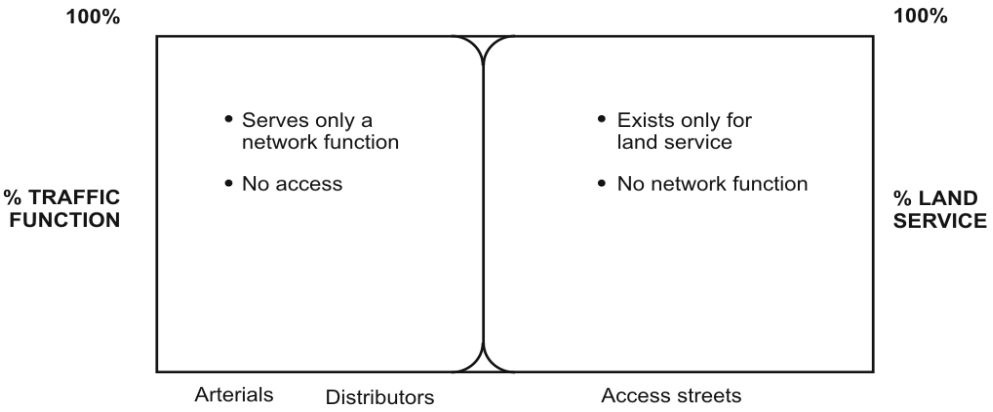


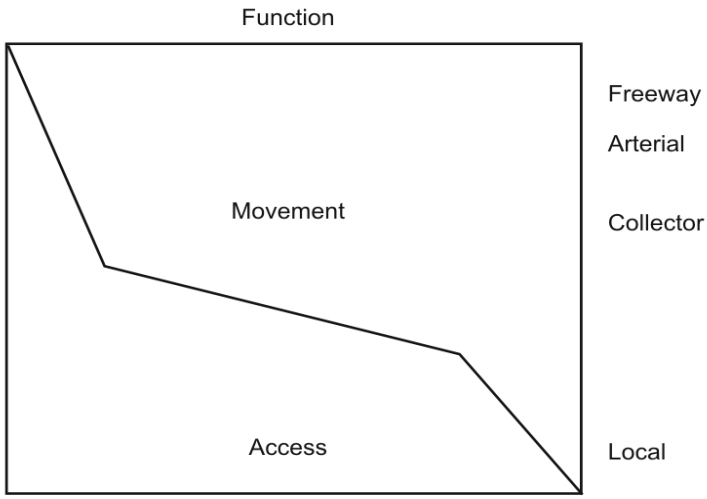
Figure 2 Highway Functional Classification (AASHO, 1964)



a) Road type and function (access vs network)



b) Two-class model of road types



c) Roadway service 'Separate Functions Model'

Figure 3 Movement versus Access (Brindle 1987, 1996)

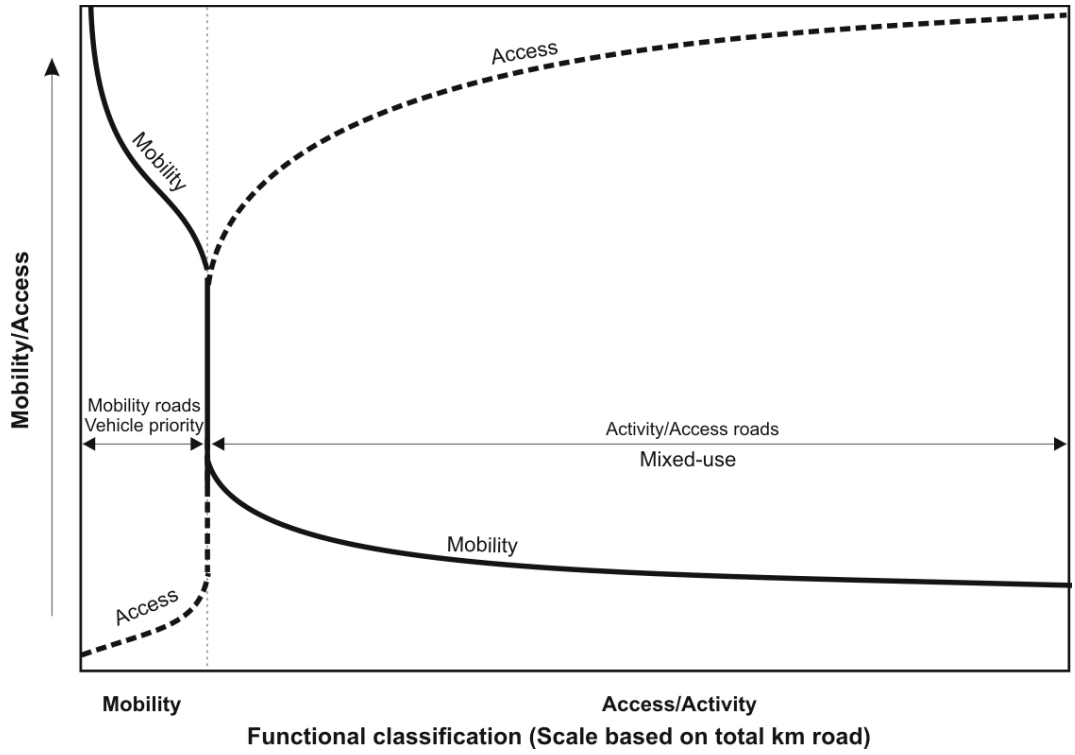


Figure 4 Mobility versus Access Function Based on Road Length (COTO, 2005)

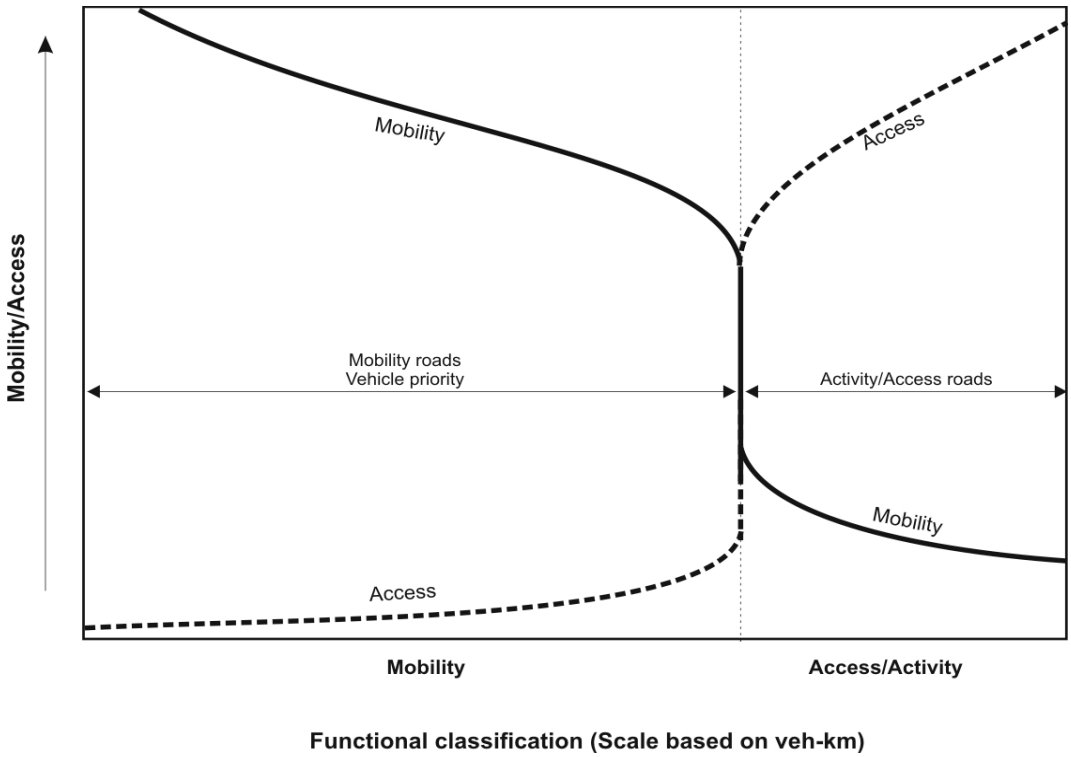


Figure 5 Mobility versus Access Function Based on Traffic (COTO, 2005)

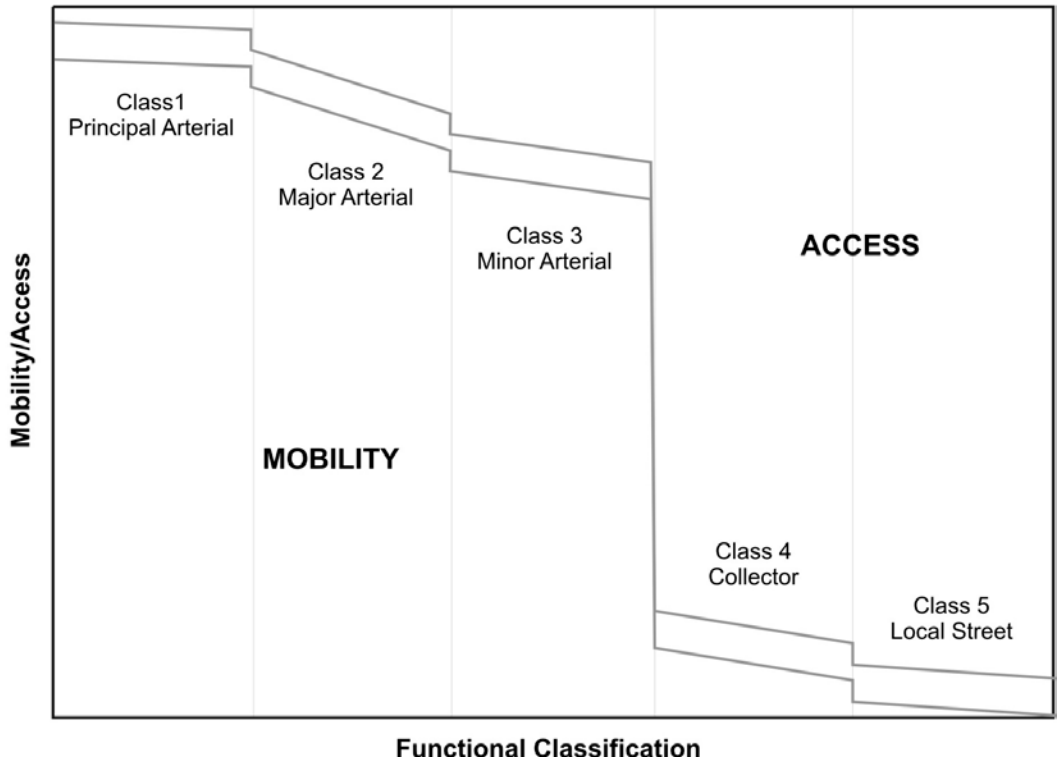


Figure 6 Road Functional Classification adopted for this Manual

The concept of a clear distinction between mobility and access roads was further developed for this Manual and is shown in Figure 6. The range shown between the lower and upper boundaries for each class is approximate and should not be taken literally, but the distinct difference in access and mobility functions between Classes 3 and 4 is deliberate.

It is however important to note that all mobility roads have some access (intersections and interchanges) and all access roads have some mobility (movement to local destinations and arterial roads).

Note also that it is not possible to distinguish a clear cut-off between the specific functions of Class 1, 2 and 3 roads and between the specific functions of Class 4 and 5 streets; as there is some overlap of functions at the boundaries.

The concept of a road having only one of two primary functions as required in this Manual is not new. In *Traffic in Towns* (Buchanan, 1963), Buchanan noted *"Basically however, there are only two kinds of roads – distributors designed for movement, and access roads to serve the buildings".*

The *Guidelines for the Provision of Engineering Services for Residential Townships* (DCD, 1983) state *"There is thus incompatibility between Access and Mobility ….* which *… suggest a degree of separation between Mobility Roads and Residential Access Streets"*. The *Guidelines for Human Settlement Planning and Design* (DOH, 2000) also separated the functions into "vehicle-only", "mixed pedestrian and vehicle" and "pedestrian only".

3.6 The six class functional road classification system

The functional classification system used in this Manual has been used for many years in South Africa as well as many countries of the world. A summary of the most popular and well known "functional" systems is provided in Table A at the end of this document, with Table A1 referring to South African systems, and Table A2 being international. The number of classes and the names allocated to them seem to vary quite considerably, but on careful inspection almost all follow a similar theme.

The system that is used in this manual is based on the six functional classes of the *Road Infrastructure Strategic Framework for South Africa* (RISFSA) (DOT, 2006) but the classes have been renamed. This system is considered to be the most well established, clearest, best understood, most widely used and the most logical system available. The system is an extension of the long standing South African Institution of Civil Engineering (SAICE, 1976) *Guidelines on the Planning and Design of Township Roads*. The system is also essentially the same system used in the COTO Road Access Management Guidelines (COTO 2005) as well as the FHWA (1989) and AASHTO (2004). The USA Transportation Research Board *Access Management Manual* (TRB, 2003) also uses nearly identical terms.

The numbering system was first introduced in South Africa for the five classes described in the Guidelines for the Provision of Engineering Services (DCD, 1983, NHB, 1995).

To the five tiered number system, the sixth class for pedestrians has been added as per the draft *National Guidelines for Road Access Management* (COTO, 2005) and the *Road Infrastructure Strategic Framework for South Africa (RISFSA)* (DOT, 2006). This class provides for non-motorised transport, and specifically for pedestrian walkways. Class 6 has been called "walkway", rather than "pedestrian priority" or "pedestrian only" as the original five categories describe road types rather than users, hence the sixth category is also a road type (walkway) rather than a road user (pedestrian).

The numbered six-class functional road classification system, which is used for both rural and urban roads, is described in the following chapter.

There are a number of other classification methods in regular use, some of which are called functional classification systems although they use other criteria such as administration or geometry, and not function, to differentiate between classes. Some of these systems are described in the following sections of this chapter.

3.7 Administrative classification

The administrative classification system is used to classify roads according to the responsible authority. The functional classification system cannot be used directly for this purpose as the administrative system is based on entirely different considerations.

Currently both provinces and municipalities have all six functional classes of roads under their control, and while national mainly have Class 1 roads, they also have some roads which would be Class 2, 3 and even Class 4 in a functional classification system. No direct correlation between an administrative and a functional classification system therefore exists at present.

At the time of writing of this document, there is no clear method to determine which roads should be national, provincial or municipal. Current legislation simply defines national, provincial and municipal roads as those declared or proclaimed as such. In other words, a road authority must declare a road if it wishes to take responsibility for that road, but there are no set rules for doing so. The South African Constitution states that provincial roads are a provincial competence and municipal roads are a municipal competence but gives no indication as to which roads should be provincial or municipal.

Regardless of which administrative classification system is applied however, each administrative authority is responsible to functionally classify and access manage their roads according to this Manual and not according to historical administrative policy.

3.8 Route number classification

South Africa has three main route numbering systems for the public, N for National, R for provincial (Route) and M for Metropolitan.

Provinces have further differentiated R routes into two digit numbers for what were originally regarded as the more major main routes, and three digit numbers for the more minor main routes. In addition to the main road numbering system, provinces also provide for minor roads using D for district roads and T for tourist routes.

The P prefix is used by provinces for administrative purposes and Gauteng uses PWV for planned freeways and K for planned highways, but with rare exceptions, these numbers do not appear on guidance signs.

While the route numbering system was originally set up by authority ownership, it no longer uniquely identifies the authority. Some provincial roads carry national route numbers and many metropolitan roads carry provincial route numbers. There are even national roads with provincial route numbers.

Route numbers are important (essential) to guide motorists, especially strangers, but they do not assist in functional classification. There are too many exceptions, un-numbered routes and inconsistencies to consider route numbering as a guide or assistance to road classification. Road authorities do change, classification changes along a route and routes are altered. It would disruptive and confusing if route numbers were changed, duplicated or became discontinuous each time such an event occurred.

Hence, while it is recommended that all mobility roads have a route number, and it is the ideal that the number relates to the class and the authority, it is not essential that the route number is strictly tied to the functional road classification system.

3.9 Road Traffic Signs Manual classification

The SADC Road Traffic Signs Manual (1996), Volume 1 classifies roads as follows for signing purposes:

a) Class A: A1 dual carriageway freeways, A2 single carriageway “freeways”.
b) Class B: B1 non-freeway numbered national, provincial, regional and metropolitan routes, B2 un-numbered surfaced routes, arterial collector-distributor streets.

c) Class C: C1 low volume surfaced routes, local collector-distributor streets, C2 un-numbered gravel, industrial streets.
d) Class D: local access, no public destination.

3.10 Geometric classification

It is common to classify roads on the basis of geometry. Freeways are considered to be the highest order, dual carriageways are second order, undivided arterials are third order etc. To consider a functional classification based on geometry is intuitive and appealing therefore, but unfortunately there is no direct relationship between geometry and function. There are numerous examples of undivided, two-lane, two-way roads which constitute much of the Class 1 network, while some dual-carriageway multi-lane collectors are Class 4.

While geometric features are not criteria for defining a functional classification system the opposite can be true. The functional classification system must guide road geometry and design standards.

3.11 Naming hierarchy

Most mobility roads and most rural activity roads are identified using a route number only, while urban access/activity streets are almost always identified by using a street name.

While a naming hierarchy is obviously not exclusively related to functional classification, for consistency the following naming hierarchy in relation to function is recommended:

Road class	Names
Mobility Roads (numbered only)	Freeway, Bypass, Motorway, Expressway, Route, Highway, Arterial
Mobility Roads (numbered and named)	Avenue, Road, Drive, Link
Access/activity Streets (named only)	Boulevard, Collector, Street, Lane, Loop, Crescent, Place, Way, Terrace, Close, Grove, Court, Square, Mall

It is also a common and recommended practice to name freeway interchanges, preferably with a nearby location name for public orientation purposes.

3.12 Public transport classification

Public transport has its own classification system, from strategic public transport routes (SPTR), integrated rapid transit (IRT), bus rapid transit (BRT) and high occupancy vehicle (HOV) priority lanes, to local distribution routes and termini. Most public transport routes, and even some strategic bus routes, will be on access/activity streets where pedestrians and bus stops are mostly found.

The presence or absence of public transport on a route may influence its importance but not its function.

3.13 Super routes

Super routes are those where extra-high, extra-wide, extra-long or extra-heavy vehicles must traverse. If possible, due to the slow moving nature of these vehicles, Class 1 and 2 routes should be avoided. Permits for abnormal vehicles must be obtained from the traffic authorities who will identify the route to be taken.

3.14 Classification for pavement management systems

According to the TRH 4 *Structural Design Life* publication and TRH 22 *Pavement Management Systems* (CSRA, 1994), roads can be divided into four categories for pavement management purposes:

Class	Description
Road Class A:	Inter-urban freeways, major inter-urban rural roads;
Road Class B:	Inter-urban collectors, major rural roads, major industrial;
Road Class C:	Lightly trafficked rural roads, strategic roads;
Road Class D:	Special pavements, access roads.

The purpose of this classification is for relating pavement management, budgeting and maintenance to the “importance” of the road in terms of its function and use. The classification should in future be directly linked to the functional classification system and the above classification therefore should not be used.

3.15 Primary, Secondary, Tertiary Classification

A further classification system which should not be used is primary, secondary and tertiary. This system has been used for construction and pavement purposes in the past but is no longer defined or required.

4 Road Classification Criteria

4.1 Introduction

The six-class rural and urban road classification system used in this manual is given in the table below. The first three classes in the system consist of mobility roads while the second three classes are used for access/activity roads or streets.

Number	Function	Description
Class 1	Mobility	Principal arterial
Class 2		Major arterial
Class 3		Minor arterial
Class 4	Access/activity	Collector street
Class 5		Local street
Class 6		Walkway

Roads must be classified exclusively on the basis of their function. The functional classification therefore cannot be derived from unrelated criteria such as the current type, size or condition of the road network. The fact that a road has been built or managed to a particular standard does not mean that it has a particular function. Functional and not geometric or condition criteria are therefore provided in this chapter for classifying roads.

4.2 Functional road classification criteria

The following primary criteria are used in distinguishing between different road classes:

a) **Size and strategic importance of the trip generator**. Mobility roads are required to link large or important trip generators and centres of development (rural or urban). Access streets give direct or indirect access to individual properties and collect and distribute traffic between those properties and mobility roads.

b) **Reach of connectivity (travel distance)**. Mobility roads are required for longer travel distances. Access roads must not be able to be used by long distance traffic. To avoid speeding in urban areas, the reach of access streets should preferably not require travel of more than 1 km before reaching a mobility road.

c) **Travel stage.** When undertaking a trip, travelling is undertaken in three stages, local at the origin, through and local at the destination. When departing from an origin or arriving at a destination, the travel is “local” in nature. Away from the origin or destination, the travel becomes “through” in nature. The local portion of a trip should be served by access roads while the through portion should be served by mobility roads.

These criteria are used to divide roads initially into the two primary classes as below, and later into the six rural and urban classes.

Primary class	Trip generator	Reach of Connectivity	Travel stage
Mobility Roads	Large or strategic generators	Longer travel	Through, destination not reached
Access Streets	Individual properties	Short connections	Local, stop at destinations

Mobility roads are those that comply with ANY one of the three criteria listed in the above table. The generator need not be large if long travel distances are involved. Roads that predominantly carry through traffic should be mobility roads and not be used for providing access.

Access/Activity streets are those that meet ALL three criteria listed in the table. The streets should only serve local traffic to and from individual properties with short travel distances to the nearest mobility road. If a street does not meet all three criteria, then it should be classified as a mobility road.

The reach of connectivity criterion is illustrated further in the following table. Note that the km distances are provided on a logarithmic scale. Note also that there is not exact cut-off between the different classes as their functions can overlap.

Km Distance:		1	2	4	8	16	32	64	128	256	512	1024
Inter-city	R1							■	■	■	■	■
	R2						■	■	■	■		
	R3				■	■	■	■				
Intra-city	U1					■	■	■				
	U2			■	■	■						
	U3	■	■	■								

The following are not used as criteria in the classification of roads:

a) **Traffic volume.** Mobility roads would typically carry higher traffic volumes than access/activity streets, but this not always the case. Mobility roads may be required to serve long distance or through travel even if traffic volumes are low, while access/activity streets serving large individual properties such as shopping centres can carry relatively high volumes of traffic .

b) **Travel speed**. Mobility roads would typically have significantly higher travel speeds than access/activity streets. Speeds can, however, be affected by numerous other factors (such as topography and geometric design). The operating speed on a road is an important access management consideration but cannot be used as a determinant of function.

The functional distinction between the different classes of roads is further elaborated on in the following sections.

4.3 Rural and urban roads

In this manual, a distinction is made between rural and urban areas. Roads in rural and urban areas have the same six functional classes but at different scales and standards. Rural roads have longer reaches of connectivity and therefore require higher levels of mobility than urban roads. It is therefore necessary that the classification system should differentiate between rural and urban areas.

The generic Class 1 to 6 descriptions (without the R or U) can be used in both rural and urban areas. However, if the context is not clear, the following classes apply:

	Rural Classes		**Urban Classes**
R1	Rural principal arterial*	U1	Urban principal arterial
R2	Rural major arterial*	U2	Urban major arterial
R3	Rural minor arterial*	U3	Urban minor arterial
R4	Rural collector road	U4	Urban collector street
R5	Rural local road	U5	Urban local street
R6	Rural walkway	U6	Urban Walkway

* If preferred, the word “arterial” can be substituted by “distributor” for Rural Classes 1 to 3.

For the purposes of this document, an urban area is defined as an area that has been subdivided into erven, whether formal or informal. It includes areas on which townships have been formally declared as well as informal settlements. Rural settlements of one hectare or less are also included in the urban definition.

A rural area is an area which is not an urban area. The areas are characterized by sparse development, mainly given over to nature or farming activities.

When a rural road enters an urban area (as defined above), it automatically becomes an urban road, preferably of the same class (unless it is a Through-way or a Bypass which is treated as rural provided its function remains that of a rural road).

Where an urban road leaves the urban area, it automatically becomes a rural road, preferably with a class not lower than that of the urban area. Short sections of “rural” roads between urban areas can sensibly be treated as urban.

The urban/rural road classification changes at the boundary of the urban area but the road design should be adjusted some distance (e.g. 500 m) in advance of the urban area to provide a transition area and to give motorists time to slow down.

4.4 Rural road classification system

The main functions of rural mobility and access/activity roads are as follows:

a) The main function of *rural mobility* roads is to connect areas that are large traffic or strategically important generators. These generators typically include cities, towns, villages, rural settlements, border posts, mining areas, seaports, airports, large game and nature parks, other mobility roads, etc.

b) The main function of *rural access/activity* roads is to provide access to individual properties, whether farms, settlements, mines, tourist areas, game and nature parks, heritage sites, etc. Animals and farm equipment should not be allowed on

mobility roads but can be accommodated on access/activity roads provided that appropriate measures are introduced to manage their impact.

Criteria for differentiating between the different classes of rural roads are a) size or importance of the trip generator, b) reach of connectivity and c) the travel stage. Some indication is also given of typical traffic volumes but this should not be used in establishing the class of road.

The provided criteria rely primarily on qualitative rather than quantitative terms. It is not possible to provide exact quantitative criteria (such as traffic volumes generated, trip length or vehicle-kilometres of travel) to distinguish between classes. However, it is possible to provide some broad guidance on the percentages of the total of different classes of roads in rural areas. These percentages are as follows (FHWA, 1989):

Rural road Class	FHWA description	Percent of veh-km	Percentage of road length
R1, R2	Principal arterials	30 – 55%	2 – 4%
R1, R2, R3	Principal plus minor arterials	45 – 75%	6 – 12%
R4	Collectors	20 – 35%	20 – 25%
R5	Local roads	5 – 20%	65 – 75%

The **Rural Road Functional Classification** is summarized in Table B at the back of this Manual and is described in the following sections.

4.4.2. Class R1 rural principal arterials

Rural principal arterials carry countrywide traffic between:

- Metropolitan areas and large cities (population typically greater than about 500 000);
- Large border posts;
- Other Class 1 Arterials; and
- Smaller centres than the above when travel distances are very long (i.e. longer than 500 km).

R1 arterials should only be used to carry through traffic and alternatives for local traffic should be provided.

Travel distances on R1 arterials are seldom less than 50 km in length. Some routes, however, can carry traffic over long distances and can even reach from one side of the country to the other,

The routes are typically characterised by higher through traffic volumes. Average annual daily traffic (AADT) would in most cases exceed 1 000 vehicles per day on the long distance routes, 5 000 veh/day on the medium distance routes and can reach 100 000 veh/day or more on shorter routes.

Class R1 arterials should preferably be *continuous r*outes that would typically serve several nodes along each route. The nodes do not have to be located on the route; in fact the route should preferably bypass the nodes, but should be located within a reasonable distance from the routes.

4.4.3. Class R2 rural major arterials

Rural major arterials carry inter-regional traffic between:

- Smaller cities and medium to large towns (population typically greater than about 25 000);
- Smaller border posts;
- Class 1 and other Class 2 routes;
- Important regions, transport nodes and commercial areas that generate large volumes of freight and other traffic such as seaports and international airports.
- Smaller centres than the above when travel distances are relatively long (longer than 200 km).

R2 arterials should only be used to carry through traffic and alternatives for local traffic should be provided.

Travel distances on R2 arterials are seldom less than 25 km in length. Some routes, however, can carry traffic over long distances and can reach from one side of a province to the other or even into adjoining provinces.

AADT would typically exceed about 500 vehicles per day on the long distance routes, 2 000 veh/day on medium distance routes but on shorter routes the volumes could exceed 25 000 veh/day.

Class R2 arterials should preferably be continuous routes that would usually serve several nodes (typically in a province). The nodes do not have to be located on the route, but should be located within a reasonable distance from the routes.

4.4.4. Class R3 rural minor arterials

Rural minor arterials carry inter-district traffic between:

- Small towns, villages and larger rural settlements (population typically less than about 25 000);
- Smaller commercial areas and transport nodes of local importance that generate relatively high volumes of freight and other traffic in the district (public transport and freight terminals, railway sidings, small seaports and landing strips);
- Very small or minor border posts;
- Tourist destinations;
- Other Class 1, 2 and 3 routes.
- Smaller centres than the above when travel distances are relatively long (longer than 50 to 100 km).

The typical length of these routes would vary between about 10 km and 100 km. These roads are not busy and traffic volumes between 100 and 2 000 per day are typical.

Class R3 arterials are not always continuous, often stopping when a particular destination is reached, although they could also serve more than one node in a district and can cross into adjoining districts.

4.4.5. Class R4 rural collector roads

These roads form the link to local destinations. They do not carry through traffic but only traffic with an origin or destination along or near the road. A collector road must never be quicker to use to pass through an area than the alternative mobility road.

These roads would typically give access to smaller rural settlements, tourist areas, mines, game and nature parks and heritage sites. The roads can also provide direct access to large farms. Collector roads can also be provided within larger rural settlements to provide a collector function in such settlements.

The length of these roads would mostly be shorter than 10 km. Traffic volumes should not be more than about 1 000 vehicles per day.

4.4.6. Class R5 rural local roads

Class 5 roads provide direct access to smaller individual properties such as within rural settlements, as well as small to medium sized farms in rural areas. They serve no other purpose than to give such access.

The length of these roads would mostly be shorter than 5 km. Traffic volumes should not be more than about 500 vehicles per day.

4.4.7. Class R6 rural walkways

These paths provide essential pedestrian and non-motorized traffic access to the road network. They are typically informal, rarely constructed and are generally the result of frequent use.

4.5 Urban road classification system

The main functions of urban mobility and access/activity roads are as follows:

a) The main function of *urban mobility* roads is to connect urban districts. They should also carry the trips entering and leaving, as well as traffic travelling through the urban area. Urban mobility roads are efficient when they serve the majority of urban travel with a minimum of road space. The roads are not intended to provide access to individual properties and lose their efficiency if they do.

b) The primary function of *urban access/activity* streets is to provide access to individual properties and to accommodate the associated activities. They must not serve traffic travelling through the area. Traffic on access/activity streets should be local in nature having an origin or destination along the street.

Criteria for differentiating between the different classes of urban roads are a) size of the trip generator, b) reach of connectivity and c) the travel stage. Some indication is also given of typical traffic volumes but this should not be used in establishing the class of road.

The size of the trip generator is an important consideration because it will determine both the number and extent (reach) of the trips using the road but it is not possible to provide detailed guidance. Guidance is, however, provided on the size of city or town in which the different classes of roads would normally be found or used. For example, it is unlikely that

Class U1 arterials would be needed to serve traffic in smaller towns but such arterials would definitely find application in large metropolitan cities.

Guidance is also provided on the required parallel spacing between mobility roads which is related to land development density. This guidance indirectly takes the sizes of trip generators into account.

As with rural roads, some indication of the proportion of vehicle travel and linear length has been given by the Federal Highway Administration (FHWA, 1989):

Urban road class	FHWA description	Percent of veh-km	Percentage of road length
U1, U2	Principal arterials	40 – 65%	5 – 10%
U1, U2, U3	Principal plus minor arterials	65 – 80%	15 – 25%
U4	Collector streets	5 – 10%	5 – 10%
U5	Local streets	10 – 30%	65 – 80%

The following percentages, obtained from the City of Johannesburg's pavement management and traffic counting systems, compare reasonably with the above percentages, except that percentage of arterial road length is relatively low in Johannesburg while the percentage of collector street length is relatively high.

Urban road class	Johannesburg description	Percent of veh-km	Percentage of road length
U1, U2	Principal and major arterials	55%	6%
U1, U2, U3	All arterials	83%	13%
U4	Collector streets	12%	13%
U5	Local streets	5%	75%

The **Urban Road Functional Classification** is summarized in Table C at the back of this Manual and is described in the following sections.

4.5.2. Class U1 Urban principal arterials

Urban principal arterials would typically be required to serve traffic in metropolitan areas and large cities (population typically greater than about 500 000). The arterials are used to provide general overall mobility to the whole metropolitan area or city but can also be used to serve important economic activity centres such as international airports and harbours.

The Class U1 arterials should also be used to serve as connectors to rural Class R1 routes. They should preferably start and stop at arterials of equal class (Class 1).

Being the longest urban routes, they often stretch from boundary to boundary and connect with other metropolitan or rural principal arterial routes. These roads would normally be 20 km or more in length.

Class U1 principal arterials are often (but not necessarily) the highest trafficked roads, typically carrying 40 000 vehicles per day or more and sometimes in excess of 120 000 vehicles per day. Because of the large volumes and the

requirement to carry high traffic flows over long distances, Class U1 principal arterials are typically freeways.

The spacing between parallel Class 1 (freeway) routes depends on the density of the area served, with a guide as follows:

Land development density	Class 1 road parallel spacing
High density (e.g. CBD)	5 km
Medium density (e.g. suburban)	8 km
Low density (e.g. urban fringe)	10 km

4.5.3. Class U2 urban major arterials

Urban major arterials would typically be required to serve traffic in metropolitan areas, cities and medium to large towns (population typically greater than about 25 000).

In metropolitan areas and larger cities, the Class U2 arterials would be used to provide connections between larger regions of the city. In smaller cities and towns, they would be used to provide general overall mobility to the whole city or town. The arterials would also be used to serve important economic activity centres that are not served by Class 1 arterials.

The Class U2 arterials should also be used to serve as connectors to rural Class 2 routes. They should preferably start and stop at arterials of equal or higher Class (1 or 2).

Major arterials should be continuous routes with a minimum length of about 10 km. The arterial would typically carry large volumes of traffic of about 20 000 to 60 000 vehicles per day.

The following criteria apply to parallel Class 1 and 2 urban arterials:

Land development density	Class 1 and 2 parallel spacing
High density (e.g. CBD)	1.5 km
Medium density (e.g. suburban)	3.0 km
Low density (e.g. urban fringe)	5.0 km

4.5.4. Class U3 urban minor arterials

Urban minor arterials would typically be required to serve traffic in most urban areas, including small towns.

In cities and larger towns, the Class U3 arterials would be used to provide connections between districts of the city or town and form the last leg of the journey on the mobility road network, bringing traffic to within one kilometre of its final destination. In small towns, they would be used to provide general overall mobility to the whole town. The arterials can also be used to serve economic activity centres that are not served by Class 1 or 2 arterials.

The Class U3 arterials should also be used to serve as connectors to rural Class 3 routes. They should preferably start and stop at arterials of equal or one higher Class (2 to 3), but can connect to Class 1 principal arterials.

Minor arterials function as through routes on a district scale. While still carrying predominantly through traffic, they serve shorter distance trips with a length of around 2 km, but can be as short as a single block if connecting higher order routes.

The minor arterials would typically carry volumes of traffic of between 10 000 and 40 000 vehicles per day.

The following spacing criteria apply to parallel Class 1, 2 and 3 urban arterials:

Land development density	Class 1 to 3 parallel spacing
High density (e.g. CBD)	1.2* to 1.5 km
Medium density (e.g. suburban)	1.2 to 2.0 km
Low density (e.g. urban fringe)	As required

* May have to be reduced to 800 m where required

4.5.5. Class U4 urban collector streets

Collector streets are used to penetrate local neighbourhoods with the purpose of collecting (and distributing) traffic between local streets and the arterial system. The streets are mainly intended to serve an access function with limited mobility and traffic volumes; trip lengths and continuity must be limited.

They should ideally not carry any through traffic but only traffic with an origin or destination along or near to the street. The majority of the traffic using the collector street will have a destination in the street itself or in a local street leading off the collector. A collector street must not be quicker to use to pass through an area than a mobility road although it is recognized that in the absence of a mobility route, collectors must allow for some through traffic, albeit at low speeds.

Class 4a major collectors may also be used in preference to arterials when “mixed” through and local traffic is unavoidable, such as when arterials pass commercial centres with no alternative access. In this case, the local access traffic must be favoured at the expense of the mobility function.

In terms of this Manual, collectors must be classified as either 4a or 4b as follows:

i) Class 4a Commercial collector street

These collectors are found in areas with commercial, business, industrial, shopping and mixed-use residential developments. The streets carry a high percentage of heavy vehicle traffic and public transport.

Typical commercial collectors are CBD streets (whether two-way or one-way), shopping centre streets, activity spines and industrial distributors.

Traffic volumes on the collectors vary greatly depending on their location. In busy shopping areas, the collectors can carry up to 25 000 vehicles or even more per day. The lengths of the roads should be limited to a maximum of about 2 km or 3 km if no through traffic is present.

ii) Class 4b Residential collector street

These collectors are found in residential areas and almost exclusively serve residential traffic and public transport.

Residential collectors should not carry more than about 10 000 vehicles per day or 1 000 vehicles during peak hours. These volumes are the maximum that can safely be accommodated on this class of streets. If Class 4b residential collector street volumes exceed 10 000 per day, this is an indication that re-classifying the road may be required.

The lengths of the roads should be limited to a maximum of about 2 km.

4.5.6. Class U5 urban local streets

Class 5 streets provide access to individual properties. As they must provide exclusively an access or activity function, both traffic volumes and trip lengths must be limited. They must not be continuous between roads of an order higher than Class 4.

Local streets should not carry any through traffic but only traffic with an origin or destination along the street, i.e. all the traffic using the local street will have a destination in the street itself.

In terms of this Manual, local streets must be classified as either 5a or 5b as follows:

i) Class 5a Commercial local street

These local streets are found in areas with commercial, business, industrial, shopping and mixed-use residential developments. The streets often carry a high percentage of heavy vehicle traffic which uses the street to access loading areas or bus stops.

Commercial local streets should not carry volumes of more than about 5 000 vehicles per day. The length of the street should be limited to a maximum of about 1 km.

iii) Class 5b Residential local street

These local streets are found in residential areas and almost exclusively serve residential traffic and possibly some public transport as well as refuse and small delivery trucks.

Residential local streets should not carry more than about 1 000 vehicles per day or 100 vehicles during peak hours. If Class 5b residential local street volumes exceed 5 000 per day, this is a criterion to classify the road as a Class 4b residential collector.

Local residential streets should be short blocks of less than 0.5 km, with one kilometre being the maximum for safety reasons.

4.5.7. Class U6 urban walkways

On all walkways, pedestrians are given priority at all times without the need for signs and road markings.

The walkway category is also sub-divided into two, Class 6a “pedestrian priority” streets or areas and Class 6b “pedestrian only” streets or areas.

i) Class 6a Pedestrian priority street or area

Within Class 6a will fall parking lots, woonerven, pedestrian malls with provision for delivery vehicles, public transport termini and private gated townhouse or cluster community streets.

ii) Class 6b Pedestrian only street or area

In Class 6b "pedestrian only" paths, streets and areas only pedestrians are permitted. On rare occasions other non-motorized transport is also permitted. Besides pedestrians therefore, cyclists, wheelchairs, prams (strollers), scooters, skate boards, dogs and possibly equestrian paths may be allowed.

4.6 Additional considerations

The criteria described in the previous sections are used to establish the functional classification of roads. In addition to the criteria, there are a number of additional considerations that must be taken into account when developing a functional road network.

4.6.1. Multiple road functions

There will be unavoidable situations when a road must serve traffic with conflicting requirements (e.g. mobility vs access). Roads with multiple functions should be addressed as follows:

i) **Mixture of mobility classes.** Maintain the highest mobility classification over the length of the route. For example, if there is a mixture of Class 2 and 3 functions on a road, then it should be classified as a Class 2 road.

ii) **Mixture of access classes.** Maintain the lowest access classification over the length of the route. For example, if there is mixture of Class 4 and 5 functions on a road, then it should be classified as a Class 5 road.

iii) **Mixture of mobility and access**. These conflicting functions must be addressed as follows:

- The first choice in this situation is to provide a bypass for the mobility traffic or a service road for the access traffic, hence separating the two functions.
- The second choice is to classify the road as mobility and retrofit the access as part of the access management process.
- The third choice is to classify the road as a Class 4a major collector and restrict the speed and design of the road section to make it safe for access traffic.

The third choice should only be used as last resort since loss of the mobility function could have serious consequences for the development of the city as a whole. The choice should also not be attempted if the section in question is longer than 2 kilometres in length. If necessary, the classification along the road should be changed to the maximum possible lengths of mobility route (greater than 3 km sections) with intermittent collector routes (less than 2 km sections). Road traffic signs and speed

limit changes must be used to warn and inform motorists at section change points.

4.6.2. Connections between different road classes

Another important principle of functional road classification is that connecting a roadway of lower classification directly to a roadway of a much higher classification should be avoided. This requirement is needed to ensure a gradual change in function over the length of a trip and to avoid lower classes of roads affecting operations on the higher classes of roads. The requirements are summarised in the following table:

Higher class	Preferable connection classes	Allowable in exceptional cases
Class 1	Class1 and 2	Class 3
Class 2	Class 2 and 3	Class 4
Class 3	Class 3 and 4	Class 5 and 6
Class 4	Class 4, 5 and 6	

4.6.3. Continuity

Mobility roads should be continuous, as discontinuities seriously affect capacity and traffic flow. Staggers and T-junctions result in “double loading” and weaving problems while the stop-start movements have the same safety problems that result from access provision.

Access/activity streets on the other hand are negatively affected if they are continuous over long lengths. These streets should be as discontinuous as possible.

5 Road Classification Methodology

5.1 Introduction

In this chapter, the methodology for classifying roads into one of the six classes is described. Different methodologies are provided for rural and urban areas.

Functional classification should be a joint exercise involving the urban planners and transportation engineers of all relevant authorities. Other disciplines can be included where relevant. Public participation is not required but the duty of professionals to protect the public interest must be paramount.

The engineers, planners and other professionals involved must be familiar with the area and the roads to be classified.

5.2 Future year classification

It is important that the road classification for the long-term future year should also be considered. This approach is required to allow for roads being classified to accommodate current conditions while another classification may be required in future. Once access management has been implemented, it is sometimes very difficult or impossible to change the classification in future.

When developments have occurred along a road, it may also not be possible to change the road classification in future. For example, a Class 2 road may be adequate for current conditions, but a Class 1 could be required in future. The error is less severe when a road is given a classification which is too high for future conditions.

5.3 Required information

The following information should be obtained for the application of the methodology (both rural and urban):

a) Obtain the largest scale map possible which includes all the relevant roads in the area being considered, being the country, province, city, town, region or district as the case may be. A scale of 1:20 000 is suitable for urban areas;

b) The outlines of the urban areas must be added to the map in order to differentiate between rural and urban roads (short sections of “rural” roads between townships can sensibly be treated as urban);

c) Obtain the existing functional classification for the roads, including roads entering the area from adjacent areas. (Commercial maps often show a classification but this not necessarily be correct);

d) Obtain any existing route numbering;

e) Obtain all plans for planned new roads available for the area;

f) Obtain any Spatial Development Frameworks and future development plans that are available for the area.

g) Obtain all required statistical data required by the classification methodology. More information on the required data is given in the sections below.

5.4 Rural/Urban transitions

Rural mobility roads link urban areas, but where a rural road enters an urban area, the rural classification must be changed to an urban classification. Preferably this point will be clear to the motorist (the approach to a major intersection or end of freeway for example) and the speed limits and access management will change accordingly.

Particular attention must be given to possible differences in current and future requirements. It is important that the classification should only be changed from rural to urban when the land use is changed. The rural road classification should however make provision that it could be changed from rural to urban in future.

Where a rural road enters an urban area, the class of the rural road should ideally be maintained (e.g. R2 must become U2). When the route continues through the urban area, it should preferably also be fairly continuous and direct. These routes may traverse the urban area from one boundary to another, or connect to another similar route.

In situations where the rural road continues through or adjacent the urban area as a Through-Way or a Bypass, the rural road classification (R) should be maintained over the length of the road.

5.5 Rural road classification methodology

The basic approach followed in the rural road classification methodology involves the identification of trip generators that should be served by the higher order mobility roads. Starting from the highest class of mobility road, the road network is then planned to serve the particular trip generators. The process is continued until a network has been developed which serves all trip generators, right down to the smallest villages and farms.

The steps of the methodology are as follows:

a) **Rural / Urban Boundaries**

Determine the rural / urban boundaries.

b) Identify and rank origins and destinations

Identify and rank origins and destinations on the basis of importance. The ranking can be based on the population statistics (obtainable from Stats SA – an example is provided at the end of this manual), but location, economic activity, employment, tourist attraction and future population growth should also be taken into account. Each urban area should be treated as one centre, even if several municipal districts are involved.

c) Establish mobility road network

Starting with the highest class of mobility road, establish a mobility road network that will serve all of the major origins and destinations. An indirect and inferential

approach may be followed to take the travel desire lines between the different generators into account.

Repeat this process for each class of road until a mobility network has been established which connects all significant trip generators. It may be necessary to extend the network beyond the last generator to the next mobility road to ensure continuity and completeness of the network.

d) Establish access road network

After establishing the mobility road network, it is only necessary to identify Class 4 collector roads (remaining roads will be classified as Class 5). These roads are identified in terms of the criteria provided in the previous chapter.

e) Check functional road requirements

Check and if necessary adjust the functional road classes to allow for the following additional considerations:

i) Multiple road functions
ii) Connections between different road classes.
iii) Continuity

f) Check road length and veh-km travel

Compare the total length of the rural road system to the guide on road length provided in the previous chapter. Where possible a check should also be made of the veh-km of travel on the different classes of roads.

Several iterations of the above process may be required before the classification system can be finalized. During the iterations, the extent of the mobility road network may have to be increased or decreased in order to comply with the total road length and veh-km travel guidelines.

5.6 Urban road classification methodology

The approach followed for the classification of urban roads is slightly different from that for rural roads. The methodology for the classification of urban roads consists of the following steps:

a) Rural / Urban Boundaries

Determine the rural / urban boundaries.

b) Identify and rank urban activity centres

Identify and rank major development nodes on the basis of importance. The importance should reflect the trip attraction of a node. The greater the importance or the trip attraction of a centre, the greater is the need to be served by higher classes of roads.

The ranking can be based on statistics such as Gross Leasable Area (GLA), number of employees, trip generation or any other suitable statistics that may be available. Future statistics should be used where possible. Where activity centres of social and economic importance cannot be weighted quantitatively, a subjective weighting can be used.

It is important that future land uses in presently undeveloped areas within and around the city should be taken into account in the classification process. This will require assumptions regarding future development in these areas.

c) Establish mobility road network

Identify a mobility (arterial) road network that serves the major activity centres (including future centres). An indirect and inferential approach may be followed to take the travel desire lines between the different centres into account.

d) Mobility road spacing and length

Check that the mobility road network complies with the spacing and other requirements provided in the previous chapter.

Also check that all mobility roads have a meaningful length and connect to other arterials or at least terminate at a major activity centre. Mobility roads should not have a length of less than about 2 km in urban areas.

If necessary amend the mobility road network based on these requirements.

e) Establish access road network

After establishing the mobility road network, it is only necessary to identify Class 4 collector roads (remaining roads will be classified as Class 5). These roads are identified in terms of the criteria provided in the previous chapter.

f) Check functional road requirements

Check and if necessary adjust the functional road classes for the following additional considerations:

i) Multiple road functions
ii) Connections between different road classes.
iii) Continuity

These problems are often more pronounced in urban areas compared to rural areas and require particular attention when classifying urban roads. In urban areas, the mobility function of a large number of arterials has been compromised over time by allowing developments with full access.

g) Check road length and veh-km travel

Compare the total length of the road system to the guide on road length provided in the previous chapter. A check should also be made of the veh-km of travel on the different classes of roads. Significant differences would indicate that the road classification should be adjusted up or down.

Several iterations of the above process may be required before the classification system can be finalized. During the iterations, the extent of the mobility road network may have to be increased or decreased in order to comply with the total road length and veh-km travel guidelines.

6 Access Management Concepts

6.1 Introduction

Access management can be defined as the systematic control of access on mobility roads and mobility on access streets. It involves the location, spacing, design and operation of driveways, intersections, interchanges and medians. It also involves consideration of road reserves, traffic control, traffic calming, pedestrian, cyclist and public transport facilities, parking and loading and indeed every aspect of road environment.

The classification of roads is of no value unless the road network is managed efficiently and effectively. It is pointless to classify roads and then not to implement measures that will enable them to provide the service required. Access management is the essential counterpart to functional classification.

Access management does not define road function, nor can it be used to assist in functional classification. None of the criteria used for functional classification are the same as the criteria used for access management. It is however essential that once the road has been determined to be in a functional category, that access is properly managed in an appropriate way.

"Access management is not an option – it is essential" (Access Management Manual (TRB, 2003)).

"By managing roadway access, government agencies can extend the life of roads and highways, increase public safety, reduce traffic congestion and improve the appearance and quality of the built environment." (Access Management Manual, (TRB, 2003)).

On mobility roads, the purpose of access management is to protect the ability of traffic to move without unnecessary impedance or delay by controlling access. Numerous accesses at random intervals severely compromise the mobility function. This is seemingly obvious, but many examples of mobility roads without access control can be seen throughout South Africa.

Conversely, if access/activity streets carry through traffic (arterial road avoidance, rat running or ducker's routes), the safety and environmental degradation resulting will mean that such streets cannot function as intended either. Numerous examples of such routes too can be seen throughout South Africa.

Access management, therefore is not simply a process of limiting access on arterial roads to improve speeds and throughput but also a process of managing access and the road environment on activity streets in such a way as to reduce travel speeds and discourage through traffic. It is a two-edged sword that applies to both mobility and access roads. This is a fundamental concept that must be well understood and appreciated.

6.2 Access types

Intersections and accesses, including driveway access, may be provided in one of three fundamental types:

a) Full intersections or accesses;
b) Partial intersections or accesses;
c) Marginal intersections or accesses.

For the purpose of this manual, both an interchange and T-junction are classified as a full intersection or access.

Different criteria apply to the three access types. Full accesses on mobility roads must meet intersection spacing requirements while this restriction can be partly relaxed for partial and marginal accesses.

A butterfly access is a full access which operates like a T-junction but with the distinction that the right-in and right-out takes place within the median island. Through traffic on both sides of the median is physically separated. Because of the slow speed of the right turning traffic movements, long acceleration and deceleration lanes are required within the median island and exiting traffic must merge in the fast lane of the through road. This is therefore an undesirable design which should only be used in exceptional circumstances and when well designed. The need to provide access to developments is not considered to be such an exceptional circumstance.

6.3 Full intersections and accesses

Full intersections allow for all possible movements of travel at the intersection as illustrated in Figure 7a.

On Class 1 arterials, urban or arterial, full access should preferably be provided by means of grade separated interchanges, although at-grade intersections may be used in rural areas where the main road has priority.

On urban Class 2 and 3 roads, full intersections are generally traffic signal controlled when warranted, although priority control may be used as an interim measure. Roundabouts may also be provided at suitable locations such as at the start or end of a route. Where traffic signals or roundabouts are not currently warranted, provision should be made for the possible future provision of such control. Interchanges, alternatively grade separated quarter links, may be warranted at the intersection of two Class 2 major arterials for capacity reasons.

On rural Class 2 and 3 roads, full intersections may be stop or yield controlled. Roundabouts and all-way stop control may also be provided subject to the requirements of this manual. These types of controls, however, can only handle limited volumes of traffic and grade separated interchanges may be required when warranted by traffic volume or safety considerations.

On Class 4 and 5 roads, urban or rural, accesses would normally be priority or roundabout (including mini-circle) controlled, but traffic signals could be warranted when traffic volumes are high.

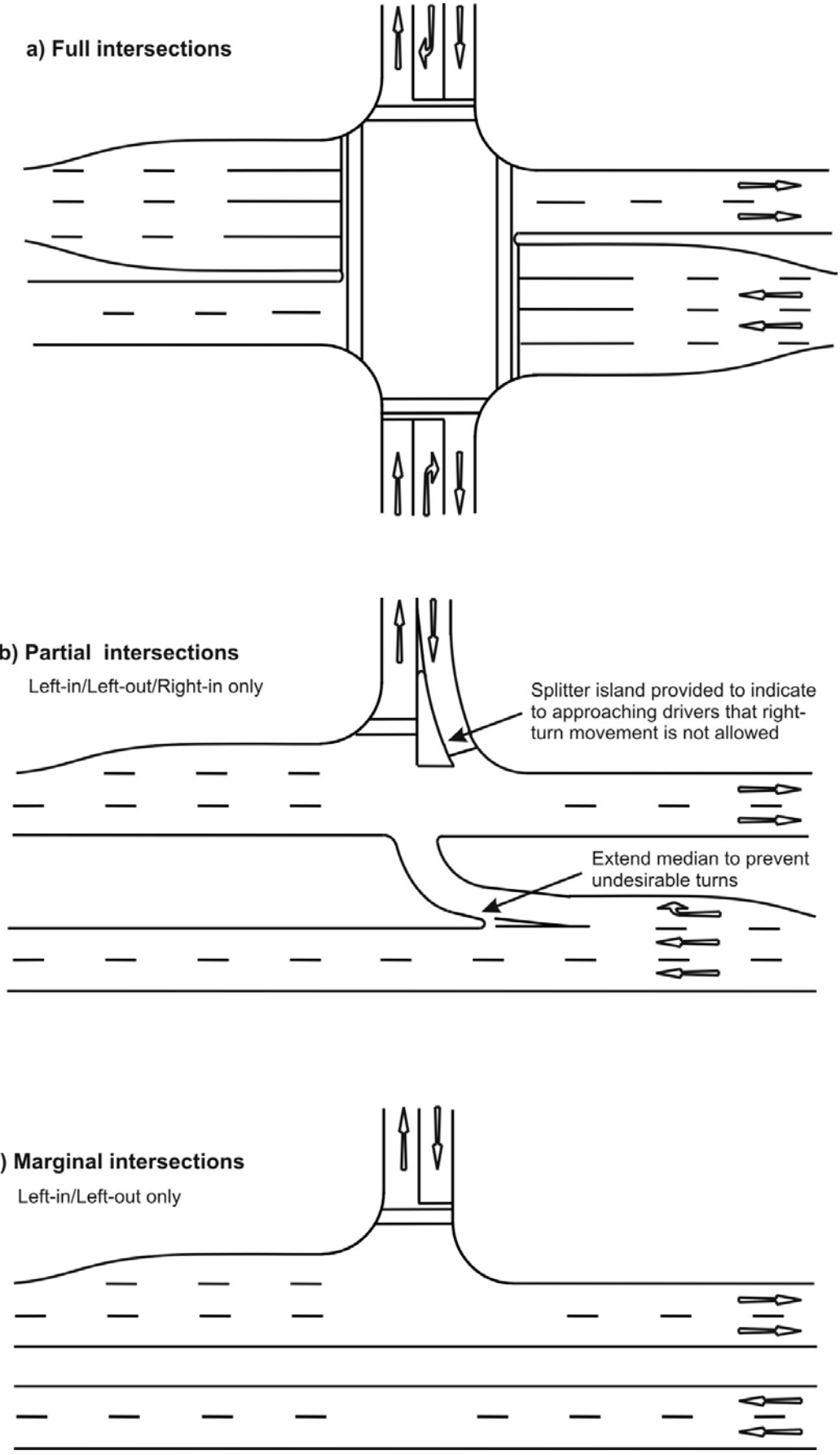


Figure 7 Fundamental intersection types

6.4 Partial intersections and accesses

Partial intersections are at-grade and only allow left-in, left-out and right-in movements, as illustrated in Figure 7b. Where possible and required, the partial intersection should be designed to accommodate U-turns.

Partial intersections are not permitted on rural roads and in urban areas they should be limited to Class 2 and 3 roads but could also be considered on Class 4 roads with medians. They should only be considered when they meet the following requirements:

- It can be shown that such intersections will be of benefit to the general road user in terms of capacity and road safety considerations;
- The intersection will attract a right-in traffic volume of 150 or more vehicles during a peak hour;
- The intersection does not attract such large volumes of pedestrians or cyclists that a pedestrian crossing (signalised or unsignalised) becomes warranted;
- Easily identifiable (by means of road signs) and safe egress routes are available for traffic to leave the area and travel in the direction not served by the partial intersection;
- A raised constructed median is available that prevents undesirable turning movements. The median must be provided over a distance extending 30 m beyond the length of the longest auxiliary turning lane that may be required on an approach to the intersection, even if such auxiliary lane is currently not provided or warranted; and
- Where traffic signals will be installed or where provision must be made for future signalisation, a minimum median width of 8 m must be available to accommodate the turning lane and traffic signals.

The partial intersection can be either traffic signal or priority controlled. Where signals are not currently warranted, provision should nevertheless be made for possible future signalisation of the intersection.

A partial intersection may be provided opposite another partial or marginal intersection. A possible configuration of full, partial and marginal intersections and accesses is shown in Figure 8. This figure shows that a total of two partial and two marginal accesses can be provided between two full intersections to provide additional access to land on both sides of the road.

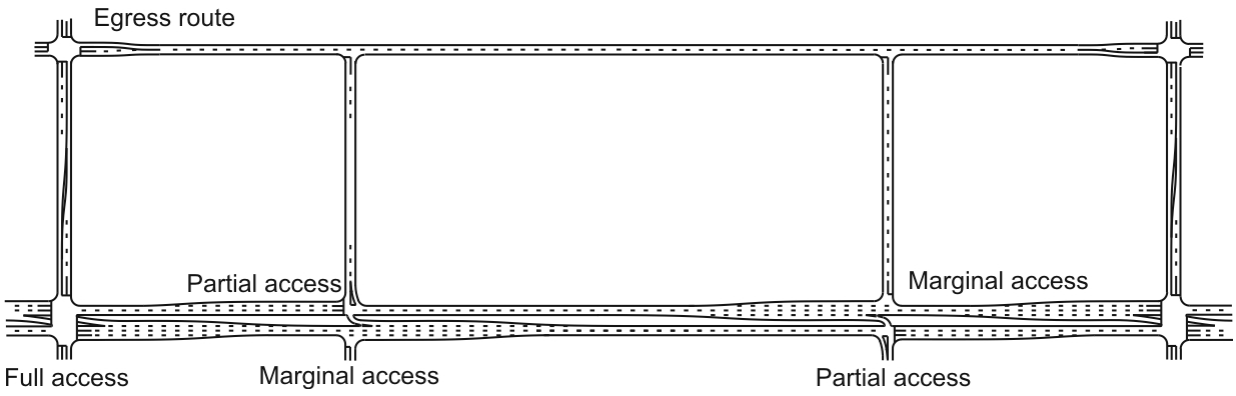


Figure 8 Partial and Marginal Access Options

6.5 Marginal intersections

Marginal intersections are at-grade and allow only left-in and left-out movements, as illustrated in Figure 7c.

On one-way roads, marginal intersections may also be provided on the right-hand side of the road, allowing right-in and right-out movements. Right-in and right-out movements may be accommodated by overlapping the turning movements or by separate roadways (not a median island) to ensure compliance with the keep-left rule of the National Road Traffic Act.

Marginal intersections and accesses are not permitted in rural areas and in urban areas should only be considered on Class 2 and 3 roads but could also be considered on Class 4 roads with medians. On other roads, full intersections or accesses must be provided.

Access to service stations, however, may be provided by means of marginal intersections on all road classes in both urban and rural environments.

Marginal intersections may only be provided when (these requirements are not applicable to service stations):

- It can be shown that such intersections will be of benefit to the general road user in terms of capacity and road safety considerations
- The intersection will attract a left-in traffic volume of 150 or more vehicles during a peak hour.
- The intersection does not attract such large volumes of pedestrians or cyclists that a pedestrian crossing (signalised or unsignalised) becomes warranted;
- Easily identifiable (by means of road signs) and safe egress routes are available for traffic to leave the area and travel in the direction not served by the marginal intersection.
- A raised constructed median is available that prevents undesirable turning movements. The median must be provided over a distance extending 30 m beyond the length of the longest auxiliary turning lane that may be required on an approach to the intersection, even if such auxiliary lane is currently not provided or warranted.

Marginal intersection may not be traffic signal controlled but may be provided opposite a traffic signal controlled partial intersection. The marginal intersection may also be provided opposite another marginal intersection or access.

Marginal accesses can also be provided as left-in only intersections or accesses that only allow left-in movements. Such access may only be provided when:

- A detailed investigation shows that such intersections will improve capacity and road safety for the general road user.
- The exit path is clearly visible and obvious, both on entry and when returning to the left-in only point to try to exit.
- Measures can be implemented that will prevent illegal egress movements.

6.6 U-turn facilities

On roads on which partial or marginal intersections are provided, consideration must be given to the provision of U-turn facilities in order to accommodate directions of travel not provided for by these accesses.

Provision for U-turns is best made by means of roundabouts. In urban areas, mid-block U-turn facilities may be considered provided that a raised constructed median of sufficient width is available to allow such U-turns for light vehicles (heavy vehicles may have to travel around the block).

U-turn facilities must comply with the requirements for partial accesses. An auxiliary right-turn lane must be provided at all U-turn facilities.

7 Access Management Requirements

7.1 Introduction

Access management requirements are the compulsory provisions necessary to ensure the road performs its function adequately. Authorities must ensure that these requirements, as a minimum, are complied with. Requirements differ from typical features (next chapter) which are desirable characteristics for the various road classes but are listed for information only.

If the access management *requirements* for a particular functional road class are not currently met, it will be necessary to implement the corrective measures such as retrofitting.

7.2 Provision of access to property

Each portion of land is entitled to access to the public road network and the right of access to the road or street system cannot be denied. This entitlement must however be allowed in a way that takes into account the public's right to a safe and efficient road system.

Direct and full access to property on Class 4, 5 and 6 streets is the norm, but nevertheless subject to the requirements of this manual. Access to individual properties on Class 1, 2 and 3 roads not meeting the requirements of this manual should normally not be allowed, but in order to comply with the right of access, access may have to be considered when all the following conditions apply:

- The access exists, and there is no other possible alternative access available to the development;
- The access does not jeopardise the possible future provision of intersections to the public road network or accesses to other developments in the area; and
- Accesses on arterials should as far as possible serve all the different properties that may benefit from such access.

Where access to property is permitted:

- The proposed access must comply with all the requirements of this manual as well as those provided in the *TMH 16 South African Traffic Impact and Site Traffic Assessment Manual* of COTO (2012).
- It is on condition that the owner of the property will be responsible for improving the access should such improvements become required. This improvement may include geometric improvements or the installation of a traffic signal, roundabout or interchange when warranted or required by the road authority;

7.3 Multiple accesses

Normally only one access per erf is allowed. However developments such as shopping centres should preferably have separate accesses for private vehicles and for large delivery vehicles. A separate access may also be desirable for use by public transport.

The spacing and separation requirements of this manual, however, are applicable to each individual access and may not be relaxed to accommodate the additional accesses.

7.4 Service stations

Access to service (filling) stations shall be subject to the same conditions and requirements applicable to other types of developments, but the following exemptions shall apply:

- Access may be provided by means of marginal access on all classes of roads in both urban and rural areas.
- Access separation requirements may be reduced as specified in this manual.

The above exemptions may only be allowed when the access is restricted to the service station only and not to shared access with any other adjacent erven or other parts of the road network. This restriction is not applicable where the access meets all the requirements provided in this chapter (i.e. if no exemptions are required to accommodate the access).

A service station may include limited ancillary facilities and services that predominantly serve the driving public.

7.5 Rural road typology and intersection control

Specific provisions for the road and intersection type for each rural road class are as follows:

7.5.1. Class R1 typology and intersection control

Class R1 rural principal arterials should be expressways or freeways.

Only grade separated interchanges are permitted on freeways, while expressways can have **intersections** provided priority is given to the through movement (no stops). In order to facilitate uninterrupted through movement (and for safety) right turn bays of adequate length must be available and left turn deceleration tapers should also be considered. If cross street traffic is sufficiently busy, the intersection should be grade separated and not signal controlled.

Access to property is not allowed along a Class R1 route, unless, in rare circumstances, the property is sufficiently large to warrant its own interchange and there is no present or future need to provide a public road intersection. Service stations on both sides or on one side with access to both directions via an interchange are exempted from this prohibition.

7.5.2. Class R2 typology and intersection control

Class R2 rural major arterials are rural highways.

Intersections should give priority to the through movement. For mobility and safety, right turn bays are essential and left turn deceleration tapers should also be considered. Occasionally grade separated intersections are found on Class 2 arterial highways. If the cross road is Class 1 or 2, stops on the R2 route may be considered.

Access to property is not allowed along such a route, unless the property is sufficiently large to warrant its own interchange and there is no present or future need to provide a public road intersection. Service stations and sometimes low volume (less the 10 vehicles per day) farm gate or tourist facility accesses are also permitted.

7.5.3. Class R3 typology and intersection control

Rural minor arterials are through routes with stops at Class 1 and 2 intersections. Traffic signals should not be considered on rural roads. Roundabouts are acceptable where the classification changes to Class 4 or 5 or when entering an urban area and there is need to reduce speeds.

For safety and capacity, right turn bays will usually be required at intersections, but left turners will not normally need separate deceleration lanes.

As a rule, access to property is not allowed along such a route, unless the property is sufficiently large to warrant its own intersection and there is no present or future need to provide a public road intersection. Access can be considered by the authority if no alternative exists and volumes are low. Service stations are acceptable and low volume (less than 20 vehicles per day) farm gate or tourist facility access can possibly be allowed on existing roads.

7.5.4. Class R4 and R5 typology and intersection control

Rural collectors and local roads have **intersections** with all road classes and **access** to adjacent land uses is to be permitted; in fact the major purpose is to give property access from these roads. Traffic signals would not be needed or allowed on rural collector roads, but stop and yield signs will be required at intersections. Commonly there will be no control signs at any of the property access points. Roundabouts are another acceptable form of control but care must be exercised that they are visible, particularly at night.

Where regular farm access is required, it is preferred that access points are placed opposite each other rather than as a series of staggered intersections.

7.6 Urban road typology and intersection control

Specific provisions for the road and intersection type for each urban road class are as follows:

7.6.1. Class U1 typology and intersection control

Urban Class 1 principal arterials must be freeways (motorways). There are no at-grade intersections on freeways, with access being provided via ramps at interchanges.

Access to freeways is much in demand in urban areas. Due to the limited number of access interchanges available, these are reserved firstly for Class 2 major arterial routes. Occasionally Class 3 minor arterials can be given access. Generally Class 4 and 5 roads should not link to Class 1 roads due to the disparate functions of these classes.

Access to an individual property is not allowed unless the property generates sufficient traffic to warrant its own interchange and there is no present or future need to provide for a public road.

7.6.2. Class U2 typology and intersection control

Class U2 typology is that of a major arterial or highway.

The most suitable form of intersection control on major arterials is co-ordinated (synchronized) traffic signal. Roundabouts can be considered but as they disrupt signal co-ordination they should only be used rarely where they do not replace a potentially co-ordinated signal position. Stop streets on the highway are not a suitable control as they are disruptive and hazardous, creating large volumes of stop-start traffic.

At a crossing of two Class U2 highways, traffic signals may not have sufficient capacity and a grade separated interchange or quarter-link could be required.

Full access to an individual property is not permitted on major arterial roads unless the development; i) is sufficiently large to warrant a traffic signal **and** ii) meets the access spacing criteria **and** iii) there is no future need for a public road. If these conditions are not met, access should be refused.

7.6.3. Class U3 typology and intersection control

Class 3 minor arterials complete the mobility road network.

The most suitable form of intersection control on Class U3 roads is co-ordinated (synchronized) traffic signals. Roundabouts can be considered but as they disrupt signal co-ordination they should only be used rarely where they do not replace a potentially co-ordinated signal position. Stop streets on the highway are not a suitable control as they are disruptive and hazardous, creating large volumes of stop-start traffic.

Full access to an individual property is not permitted on minor arterial roads unless the development i) is sufficiently large to warrant a traffic signal **and** ii) meets the access spacing criteria **and** iii) there is no future need for a public road.

7.6.4. Class U4 typology and intersection control

Urban Class 4a streets are typically designed as major collectors and Class 4b as minor collectors (SAICE, 1976). Auxiliary turning lanes are not required on Class 4 streets and their use is discouraged for traffic calming reasons except at traffic signals where they are essential. At intersections with mobility roads, it is essential to ensure the side road has spare capacity in order to be able to give more green time to the main road.

Class 4a intersection controls should allow for a relatively high percentage of heavy vehicle and buses, hence traffic signals, modern roundabouts and priority controls are appropriate. Traffic signals need not be co-ordinated (synchronized) and roundabouts can be placed between signalized intersections if appropriate.

On Class 4b streets with much lower volumes of heavy vehicles, mini-circles, priority control and roundabouts are all appropriate, with traffic signals reserved for intersections with mobility roads.

7.6.5. Class U5 typology and intersection control

Class 5 local streets must be designed to restrict high traffic volumes.

Intersection control should be priority stop or yield signs or mini-circles, with care taken not to allow long straight lengths with no restrictions which might encourage speeding.

7.7 Intersection spacing and access separation definition

The difference between intersection spacing and access separation is illustrated in Figure 9 below. Intersection or access spacing is the distance between the centre lines of connecting intersections or access roadways, whereas access separation is the distance between the insides of road reserves, or where applicable, roadway edges.

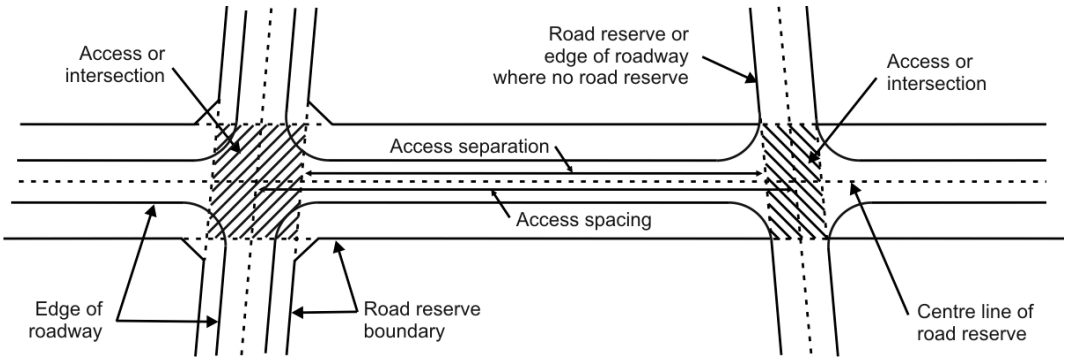


Figure 9 Access Spacing and Separation

7.8 Freeway interchange spacing

For reference, examples of minimum rural and urban freeway interchange spacing obtained from international and local literature are given in Table 1 and Table 2.

Table 1 Minimum Spacing between Rural Freeway Interchanges (GDPTRW, 2004)

Interchange type	YLBP* spacing (m)	Centre line spacing (km)
Access to access	2 170	2.8 km (abs. min 2.4 km)
Access to systems	3 270	4.2 km (abs. min. 3.6 km)
Systems to access	2 170	2.8 km (abs. min 2.4 km)

Table 2 Minimum Spacing between Urban Freeway Interchanges (GDPTRW, 2004)

Interchange type	YLBP* spacing (m)	Centre line spacing (km)
Access to access	1 300	1.5 km
Access to systems	2 100	2.4 km
Systems to access	1 420	1.6 km

*YLBP is yellow line break point, the final point at which the on-ramp ends or the first point at which the off-ramp starts. All road signing and weaving ideally takes place between YLBPs.

7.9 Intersection spacing considerations

The intersection spacing requirements provided in this section is based on the following main considerations:

- Traffic safety;
- Mobility and access requirements;
- Traffic signal co-ordination (only on Class 1 to 3 roads);
- To allow sufficient decision and reaction time;
- Accommodation of partial and marginal accesses.

Traffic safety on mobility roads requires access spacing to be as far apart as possible, thus reducing conflict and the need for stopping and starting but access and side road capacity requirements dictate the opposite; hence a compromise is necessary.

Universally, an 800 m (half mile) spacing between intersections is required on arterial roads. The spacing requirements apply regardless of the type of control (traffic signals, roundabouts or stop streets).

In this Manual the standard 800 m spacing is the requirement on Class U2 arterials, but a 600 m spacing between intersections on Class U3 arterials is allowed as a concession. Traffic signal progression determines that, at practical cycle times, an intersection spacing of around 800 m will allow a two-way progression speed of between 60 and 80 km/h. At a spacing of 600 m, the progression speed is reduced to between 50 and 70 km/h. More details on the impact of spacing on two-way progression are provided in Annexure A.

On one-way streets, it is possible to achieve traffic signal progression regardless of the travel speed and intersection spacing. On the leg of T-junctions, co-ordination can be achieved at exactly half the normal signal spacing. For these two road types, the

requirements for intersection spacing are therefore relaxed to 50% of the normally required spacing.

In rural areas, the traffic safety and mobility considerations dictate access spacing requirements and these are considerably longer than urban requirements (see Tables 3 and 4).

7.10 Spacing requirements by class

The spacing requirements for full intersections by mobility road class are provided in Table 3 and recommendations for access/activity streets in Table 4.

On Class 2 and 3 roads, a percentage leeway is allowed on either side of the required spacing. The recommended (or longer) spacing should be maintained as far as possible but the shorter spacing may be considered according to circumstances.

For Class 4 and 5 roads a spacing range is specified. The longer spacing should be maintained as far as possible but the shorter spacing may be considered according to circumstances.

Table 3 Minimum Spacing Requirements for full Intersections on Mobility Roads

Class	Rural	Urban signals(*)	Urban roundabouts and priority(*)
Class 1	8.0 km	n/a	n/a
Class 2	5.0 km	800 m ± 15%	800 m ± 15%
Class 3	1.6 km	600 m ± 20%	600 m ± 20%

(*) These values can be halved for the leg of T-junctions and for one-way streets.

Table 4 Minimum Spacing Recommendations for Intersections on Access Streets

Class	Rural	Urban signals	Urban roundabouts and priority
Class 4a	600 - 800 m	200 - 300 m	200 – 300 m
Class 4b	600 - 800 m	150 - 250 m	150 – 250 m
Class 5a	450 - 600 m	150 - 250 m	150 – 250 m
Class 5b	450 - 600 m	150 m	75 - 150 m

7.11 Access separation requirements

The separation requirements provided in Table 5 below are for marginal and partial accesses on Class 2 and 3 roads in urban areas. No requirements are provided for rural roads or other urban road classes since marginal or partial intersections should not be provided in rural areas and should not be needed on activity streets.

They are based on the following considerations:

- Traffic safety;
- Functional area of intersections (e.g. auxiliary turning lanes, etc);
- Provision of a bus stop downstream of the intersection or access;

- Turning onto a road between accesses;
- Lane selection and lane changing between intersections;
- Stopping and queuing at an intersection;
- Reaction to the control at the intersection.

The longer spacing should be maintained as far as possible and the shorter spacing should only be considered under exceptional circumstances.

Table 5 Minimum Access Separation for Class U2 and U3 Roads

Intersection / access configuration	Class 2	Class 3
Right-turn lanes not required at any of the intersections	150-175 m	125-150 m
Right-turn lanes required at one intersection only	150-175 m	125-150 m
Right-turn lanes required in series at both intersections*	250-300 m	200-250 m
Service station upstream of intersection**	125-150 m	100-125 m
Service station downstream of intersection***	150-175 m	125 -150 m

* The separation requirements for this configuration can be reduced in situations where the right-turn lanes at the two intersections can be provided in parallel rather than in series.

** The requirements are only applicable when no bus stop is required between the access and the intersection. Otherwise, the separation applicable for accesses downstream from an intersection must be applied.

*** The separation provides for a bus stop downstream of the intersection. Where a bus stop is not required (now or in the future), the upstream spacing may be used.

7.12 Parking

On-street parking has a significant impact on road safety and the capacity of a road. According to the Access Management Manual (TRB, 2003), the prohibition of on-street parking could lead to a 30% increase in traffic flow and a 20% to 40% reduction in collisions. In a review of literature on the impact of on-street parking on accidents, Paul Box (Transportation Research E-Circular E-C019, 2001) found that kerb parking, if allowed, contributes unduly to accidents, ranging from about 40% of total accidents in two-way major streets to 70% on local streets. Higher proportions have been found on one-way streets too.

No on-street parking is therefore allowed on rural roads, or urban mobility arterials. On-street parking will only be allowed on Class 4 and 5 urban streets when all the following requirements and conditions are met:

- The road must be a destination for vehicular traffic and not carry any through traffic;
- The total traffic volume on the roadway (in the two directions) should not exceed a maximum of 1 000 vehicles during any hour;
- A maximum speed limit of 50 km/h must be in place;
- Sufficient sight distances must at all times be available (including stopping, decision, intersection, and pedestrian sight distances). Sight distances may not be blocked by parked vehicles.

7.13 Route numbering requirements

Route numbers are a requirement on all mobility roads and are not permitted on any access/activity streets. Road numbers are permitted on any road or street but must not be confused with route numbers. Tourist routes (brown sign, T prefix) can however be used on both mobility and access/activity routes.

In urban areas, the naming of Class U4, U5 and U6 streets should be preferred to a road number as the display of a road or route number tends to give the impression that the route is continuous. In rural areas road numbering rather than a name is usually used to identify Class R4 and R5 roads.

Table 6 provides the preferred and alternative numbering systems for different road classes. The alternative should be used if the preferred system is not available or not practical.

Table 6 Route Numbering Conventions

Class	Rural		Urban	
	Preferred	Alternative	Preferred	Alternative
Class 1	N	R	M 1 - 9	N, R or M 10+
Class 2	R 10 - 99	R 100 – 999, N	M 10 - 99	R
Class 3	R 100 - 999	R 10 - 99	M 10 - 999	R
Class 4	D or T	Number or name	Name	A
Class 5	L or T	D or name	Name	-

In the table, N stands for National, R for (provincial or regional) Route, M for Metropolitan, D for District, T for Tourist and L for Local. “A” stands for an Access/activity street through which a route passes temporarily (e.g. when a mobility route passes through an urban CBD area). For A routes, the route number and basic shape of the primary route can be retained, but the A is an attempt to inform motorists that they are no longer on a mobility route where it passes through an activity centre.

A cardinal direction (*N, S, E or W*) is often added in italics after the route number to aid navigation in urban areas, especially on the cross road direction signs approaching a freeway. This approach is recommended.

7.14 Variance in requirements

The requirements and standards provided in this chapter should be complied with as far as possible. It should, however, be recognised that it not always possible to comply with all the requirements and that provision should be made for variance in exceptional circumstances.

Road authorities are often placed under tremendous pressure by developers to allow accesses to developments that do not comply with the requirements and standard. To address this problem, authorities should not allow any access that does not comply with the requirements when an application is made by a developer of a property. Developers may, however, request the authority to consider variance to accommodate exceptional

circumstances during a next cycle of review of the road classification system and access management frameworks or plans.

During the development or review of the classification system and access management frameworks or plans, the technical team should not be exposed to any undue pressure to reduce requirements or standards. Variance should only be considered when there is clear need and motivation in terms of network operation. Direct access to a particular property would normally not be a motivation for reduced standards.

8 Access Management Typical Features

8.1 Introduction

Access management typical features differ from access management requirements in that although the typical features may be desirable characteristics, they are not mandatory.

8.2 Road access management plans and frameworks

Access management plans are plans showing the locations and types of intersections and how accesses to individual properties will be achieved on the road network. The plans can also be used to show lines of no access, or locations where access will be denied. The plans may also include conceptual designs of the accesses as well as retrofit measures that may be required.

Experience with access management plans in South Africa has indicated that these plans should not be too detailed because actual developments may deviate significantly from assumptions and the planned accesses then have to be changed, rendering the plans obsolete.

It is therefore recommended that authorities should rather develop access management frameworks which will provide general guidance, requirements and conditions for access from a particular road class. Such frameworks are particularly needed on roads that do not currently fully comply with the requirements and standards of this manual and where retrofit measures are required to provide access. Where no such framework is provided, the full requirements of this manual will apply.

8.3 Design speeds

Various standards and requirements for roads in this manual depend on the design speed selected. Recommended design speeds are provided in Table 7 for the different road classes.

The speed limits on the different road classes should correspond with the design speeds provided in the table. On Class 4b, 5a and 5b streets in urban areas, traffic calming measures should preferably be used (if necessary) to limit operating speeds (rather than speed limits).

In situations where the topography or other restrictions do not permit the design speeds provided in the table, a lower design speed may be used provided that corresponding advisory speeds are posted on the road sections where a lower design speed is applied. Where the lower design speed is required over the full length of the road, a speed limit may also be used.

Table 7 Design speeds (km/h) for different road classes

Area	Class 1	Class 2	Class 3	Class 4a	Class 4b	Class 5
Urban areas	120*[1]	80	70	60	50	40
Rural areas	120*[2]	120	100-120	80-100	80-100	60-80

*[1] A lower design of 100 km/h may be considered on shorter routes

*[2] Higher design standards should be used where possible with the aim of improving safety

8.4 Road reserve width

Typical road reserve widths for the different classes of roads are provided in Table 8 below.

Table 8 Typical Road Reserve Widths (m) for Different Road Classes

Class	Rural		Urban	
	Typical	Range	Typical	Range
Class 1	62	60 – 80	60	60 – 120
Class 2	48	40 – 70	40	38 – 62
Class 3	30	30 – 50	30	25 – 40*
Class 4a	25	-	25	20 – 40
Class 4b			20	16 – 30
Class 5a	20	-	22	15 – 25
Class 5b			14**	10 – 16

* Reserve up to 62 m is required to allow for Strategic Bus Rapid Transit (BRT).

** Reserve of 10.5 m is typical if street is less than 100 m long.

8.5 Pedestrian and cyclists

In general, pedestrian and bicycle facilities should be provided anywhere where there is a reasonable expectation that such facilities will be used by pedestrians and cyclists, even if the numbers of pedestrians and cyclists are relatively low. Pedestrian footways and bicycle lanes should be standard on urban Class 4a, 4b and 5a streets (in urban Class 5b streets pedestrians and cyclists use the roadway). The standards of such facilities must be such that they will promote increased pedestrian and cycle use.

Pedestrian facilities on mobility roads are ideally not required, but when necessary should be physically separated to avoid mixing slow moving vulnerable pedestrians with high speed traffic. Constructed footways, if provided, should preferably be some distance from the road edge. Mid-block crossings are not permitted on mobility roads.

One-way cycle lanes of 1.8 m wide (1.2 m minimum) should be provided where necessary on mobility roads by widening the carriageway or could be incorporated alongside the pedestrian footway if there is one. Two-way cycle lanes (off-road) need to be 2.5 m to 3.5 m wide.

On rural roads, pedestrians and cyclists would normally use the shoulder of the road. However, sidewalks and bicycle lanes may also be provided on rural roads where pedestrian and cyclist volumes are high.

8.6 Public transport facilities

The provision of public transport facilities on the road network is not only aimed at enhancing public transport, but also to improve traffic flow and road safety. Such facilities reduce the number of conflicts on mobility roads and can therefore make a significant contribution to the reduction in collisions.

Public transport stops can be provided as follows on the following classes of roads (the requirements apply to both rural and urban roads):

- No stops may be provided on Class 1 roads;
- Stops on Class 2 roads are restricted to lay-byes downstream of intersections;
- Stops on Class 3 roads are restricted to intersections, preferably downstream, and should be in lay-byes;
- There is no restriction on public transport stops on Class 4 and 5 streets and lay-byes are not required.

Public transport stops should be located within an acceptable walking distance from generators, attractors and modal transfer facilities. Walking distances to the stops should preferably be within 400 m but not more than 800 m. Public transport stops must be served by an adequate network of footways.

On-street public transport stops should be located as near as possible to intersections and major accesses. At traffic signal controlled intersections, the stops can be located on the approach, but preference should be given to the far side as the stop can be placed closer to the pedestrian crossing points. When provided on approaches, the stops should be located sufficiently far back to prevent the intersection or access being obstructed by the stop.

In the absence of a pedestrian footpath, paving should be placed at public transport stops to allow a clean and dry place for pedestrians to stand and place luggage. Shelters are also recommended at all public transport stops.

8.7 Traffic calming

Traffic calming is often required to protect residential and other sensitive land uses against the negative impact of traffic. High speeds and large volumes of traffic can negatively affect communities and reduce the safety and quality of life in these areas.

Traffic calming is not permissible and can create an even more dangerous situation on urban and rural mobility roads. Traffic calming can however be provided on any activity street, particularly Class 4b and 5b residential streets where there are problems with speeding or traffic intrusion.

Traffic intrusion control involves introducing measures aimed at limiting or restricting traffic volumes or through traffic in residential areas. Measures include the following:

- Ensuring that the residential streets do not serve very large developments;
- Ensure the street is not continuous;
- Limit the total length of a trip through a sensitive area;
- Divert traffic through semi-closures at intersections or short sections of one- ways (long one-ways encourage speeding);
- Close the street, either at an intersection or at some midblock location;
- Control access by means of gates or booms (relatively ineffective).

Speed control measures include the above plus:

- Implement roundabouts and mini-circles;
- Narrow the road, to one lane if necessary;
- Curve the street by design or with kerbs and markings;
- Provide raised pedestrian crossings (especially at schools);
- Provide short sections of median islands;
- Introduce traffic cameras that are highly visible.

Speed humps and four way stops should be avoided as “traffic calming” measures. These ineffective solutions seldom achieve anything other than “traffic aggravation”, adding to road rage and disobedience of signs and can even increase the number of collisions due to the different speeds and reactions of drivers, both at the restriction and elsewhere.

9 Access Management Implementation

9.1 Introduction

As has been emphasized throughout this Manual, road classification and access management are separate, independent procedures and must therefore be implemented in two steps. Road classification should be completed and approved before access management is implemented.

Road authorities must actively support and implement road classification and access management plans which will, amongst other things, eliminate pressure on officials to make ad hoc decisions on access provision. Accesses not meeting the defined plan are automatically refused without further consultation or argument being necessary.

The active identification of acceptable road accesses, which will fall naturally in place when the road classification and access management process is complete, provides a coherent frame of reference for both the developer and the road authority and introduces certainty in the planning process.

In this chapter, the process of implementing access management is described and the procedure for retrofitting roads which have not been managed according to their function is prescribed.

9.2 Implementing access management

The following are a number of guidelines for the implementation of access management:

a) In urban areas, ensure that all the mobility roads have a route number and that no access/activity streets have a route number. If this is not the case, make arrangements to correct the situation or, in exceptional cases, allow for the activity (A) route number over short distances (less than 2 km) between mobility roads.

b) Ban all parking and loading on the mobility arterials. If necessary, construct physically separated service roads and/or parking areas to cater for the displaced parking.

c) Divide the Class 1, 2 and 3 road network into sections, each section to be defined by the intersection with a Class 1 or 2 mobility arterial (this should result in sections of between 1.5 km and 5.0 km long in urban areas).

d) Record the spacing between full accesses in each section of mobility road. Include any property accesses between intersections.

e) Fit a “ruling spacing” so as to include as many intersections as possible around that spacing. The ruling spacing is 800 m or more on Class 2 roads and 600 m or more on Class 3 roads, but can be adjusted to no less than 480 m to suit site conditions.

f) If the existing spacing of individual intersections is less than 500 m on major or minor arterials, try to identify closely spaced intersections which can be treated in groups, bearing in mind that only existing public road or freeway ramp intersections may be grouped. Closely spaced intersections (signalized or not) are those within 120 m on either side of the ruling spacing which spacing must be 600 m or more for grouping purposes.

g) If the spacing between individual intersections is less than that allowed for the relevant Class, record where the section requires retrofitting (see below). It is not acceptable to simply reclassify the section at this stage in order to avoid removing traffic signals, especially as the road classification should have already been officially approved before the access management process started. However, if retrofitting is not possible and it is believed that reclassification can be done without compromising the network as a whole, then there may be no alternative but to redo the classification exercise. Due consultation with the team involved in the original functional classification exercise must then be held and the road classification exercise must be reconsidered.

h) Following the above exercise, the approved intersection points to the mobility road network will be known or can be identified. Activity streets are now considered.

i) Start the Class 4 and 5 (and 6) activity streets at the identified intersections.

j) Check that the activity routes are not continuous or that traffic does not have to travel more than one kilometre to the nearest mobility route. If it does, this will lead to incompatible uses, such as high volumes of through traffic, high speeds or danger to pedestrian and other traffic. If any of these situations are present, then road closures, deviations, reduced speed limits and/or traffic calming measures listed in section 8.8 are required.

k) Check that the entire network against the Integrated Transport Plan (ITP) and Integrated Development Plan (IDP) and make adjustments as necessary. Incorporate the RCAM plans into the Spatial Development Framework (SDF).

10 Retrofitting

10.1 Introduction

The application of access management to an existing mobility arterial network poses various challenges. Most of these roads were planned and constructed at a time when traffic volumes were relatively low and access management was not exercised. Many of the older or poorly managed arterials are characterized by:

- Closely spaced full accesses to individual properties;
- Excessive numbers of traffic signals at closely spaced intervals;
- Insufficient turning lanes at intersections, particular right-turn lanes;
- Absence of median islands or numerous breaks in median islands;
- On-street parking;
- Inadequate supporting road network.
- Random pedestrian crossings.

The only solution to these problems is by means of retrofit techniques. This generally involves installing a physical median barrier along the middle of the road for the full length between those intersections meeting the access spacing requirements and creating marginal and partial accesses in between, but other solutions should also be considered.

It can be expected that affected property owners and businesses will be opposed to any access control measures, especially if the business has paid for a traffic signal that has to be removed. Historical rights in such areas are important and have to be taken into account, but the rights of the majority of road users to proper mobility and the rights of other property owners to equal accessibility must be given priority.

Various retrofit measures are discussed in this chapter. Some of these are more effective than others, while there may also be practical implementation problems. Retrofitting often involves site specific solutions.

10.2 Access relocation or closure

One of the most effective retrofitting measures is to close unsuitably located accesses and relocate them to locations that are more appropriate, such as a narrow road at the back of the properties. The consolidation or sharing of accesses by two or more adjacent properties is another method of reducing the number of accesses.

While effective, these measures are often also the most difficult to implement since it could have a significant impact on a development. There may be situations where this approach is possible, but in most cases the approach results in high implementation costs.

The measure can, however, be implemented as part of a condition for the rezoning of a property. Such rezoning can then be made subject to the condition that the access will be

relocated to a more suitable location or that access must be shared between different developments.

The argument is often made that it difficult to implement the consolidation or sharing of accesses since it is alleged that other developers are not prepared to co-operate. In practice it has been found that this argument is often made to pressurise the authority to approve additional access. Authorities should in any event not accept such arguments for access, whether or not consolidation is possible.

10.3 Intersection and access control

The use of appropriate and effective intersection and access control measures will contribute to improved traffic flow and road safety. Priority control can be effective when traffic volumes are low and the number of conflict points restricted (such as at marginal accesses). However, at higher traffic flows, priority control becomes ineffective and other forms of control may become warranted. While traffic signals are effective in improving the capacity of a side road or access, they can only be considered when warranted and where intersection spacing requirements are met.

The modern roundabout is an alternative form of control that can be very effective and efficient, especially in retrofit situations. Roundabouts readily accommodate right turn and U-turn movements. This is particularly advantageous on roads on which marginal accesses have been provided as these result in a demand for U-turns at downstream intersections.

Improving the geometric design of intersections may contribute to reducing friction on a road. Improvements could include the provision of left- and right-turn auxiliary lanes and slip roads. Right-turn lanes are particularly effective in improving capacity and improving road safety.

10.4 Median provision

The provision of a median along a road makes a significant improvement to the mobility function. Medians eliminate conflicting right-turn and crossing movements thus reducing congestion and improving road safety. Wider medians can also be used to accommodate the demand for U-turns that are a result of the median construction.

Another advantage of medians is that they provide shelter for pedestrians on those arterials where pedestrians cannot be prevented from crossing; alternatively medians provide a place for barriers to be erected to block undesirable pedestrian crossing movements. If used to shelter pedestrians, the median must be not less than 1.0 m wide.

10.5 Parking

The removal of on-street parking is an important retrofit technique that significantly improves traffic operations and road safety on arterial roads. The removal of parking reduces traffic conflicts, including that between vehicles and pedestrians, reduces the interruption of through traffic by parking manoeuvres and creates the opportunity to provide turning lanes to increase capacity and improve efficient traffic flow.

10.6 Supporting road network

A problem that is often found in both urban and rural areas is the inadequate provision of a supporting road network resulting in access roads or streets also serving a mobility function. There must be a proper network of arterials to provide for the safe movement of traffic and to enable activity streets to provide the required safe access to properties.

An effective technique of providing a supporting road network is by means of frontage (service) or backage roads. Such roads eliminate the need to provide direct property access from the mobility road by providing an alternative. The frontage road is provided in front of the properties, adjacent to the mobility road, while the backage road is provided behind the properties, often in a narrow one-way servitude on the back boundary.

10.7 One-way systems

One-way roads can be very effective in addressing operational and safety problems, particularly in areas with high levels of development. A closer spacing of traffic signals can be accommodated since signal progression is easily achieved. One-way systems can however increase travel distances and are not suitable for activity streets as speeds tend to increase.

10.8 Retrofit techniques in residential areas

The most effective way of calming residential streets and getting streets back for the use of the local residents is to provide adequately for the mobility needs on arterials outside the area. Retrofit techniques in residential areas are aimed at reducing traffic speed and diverting extraneous traffic by restricting connectivity. This eliminates the general disturbance caused by traffic intrusion on residential streets. Traffic calming has therefore become an important measure to resolve traffic problems in many existing residential areas.

Many residents, especially in less privileged areas, need to use the road reserves outside their dwellings as an extension of their residential environment. Examples of such uses include parking, walking, cycling, children's play, soccer, cricket, meeting neighbours and even social events such as street parties. These activities require that less priority should be given to traffic needs, and more attention given to the needs of residents.

If the road is not continuous, it will only be used by residents. The closure of a road is therefore a sure and effective method of preventing traffic intrusion. Roads can be closed in the middle or at the end of a block, particularly where the road joins a high order road. An alternative method is to close intersections diagonally. Disadvantages, however, are longer travel distances, the possible diversion of traffic to other streets that previously did not experience traffic intrusion problems and the increased possibility of getting lost. Road closures are therefore not always possible or an ideal solution.

Through traffic can be discouraged from an area by increasing both travel time and travel distance through the area. A large number of traffic calming techniques are available, but many of these, such as speed bumps, do not increase travel distance and are relatively ineffective in reducing travel time.

Use can be made of chokers on local roads to restrict the capacity of a road. Such chokers only allow a limited volume of traffic to use a road, one direction at a time, and therefore physically control the maximum traffic throughput. Other traffic is forced to divert to other roads. Although the chokers cannot divert all traffic, they can be effective in reducing high peak traffic volumes. During off-peak periods, the chokers could still be effective as a speed control mechanism as extraneous traffic usually would not want to risk being delayed.

It is important to emphasise that traffic calming measures are only appropriate on access/activity streets. Such measures must not be introduced on arterial roads where high levels of mobility are required.

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Annexure A

Traffic signal co-ordination requirements and leeway

The requirement of an 800 m spacing between intersections is necessary to ensure that the traffic signals can be co-ordinated in both directions at between 60 and 80 km/h with cycle times of between 70 and 100 seconds (refer to Figure 1 below). A 50 to 70 km/h travel speed can be achieved for through traffic with a 600 m spacing provided the cycle times are in the 60 to 90 second range. If the arterial ends in a T-junction, half these spacings are required, but arterials should be continuous so this should rarely occur.

These spacing requirements also apply to vehicle actuated signals. Arguments that sophisticated computer programs can time signals to avoid the spacing requirements for two-way through traffic synchronization are not valid.

It is however recognized that to put intersections at exactly 800 m or 600 m apart, or any other exact distance, is not practical. On Class 2 roads therefore, a leeway of 15% (120m) on either side of the ruling 800m spacing is allowed, and on Class 3 roads, a 20% (120m) leeway on either side of the 600m ruling spacing is similarly permitted. This is illustrated in Figure 2 below.

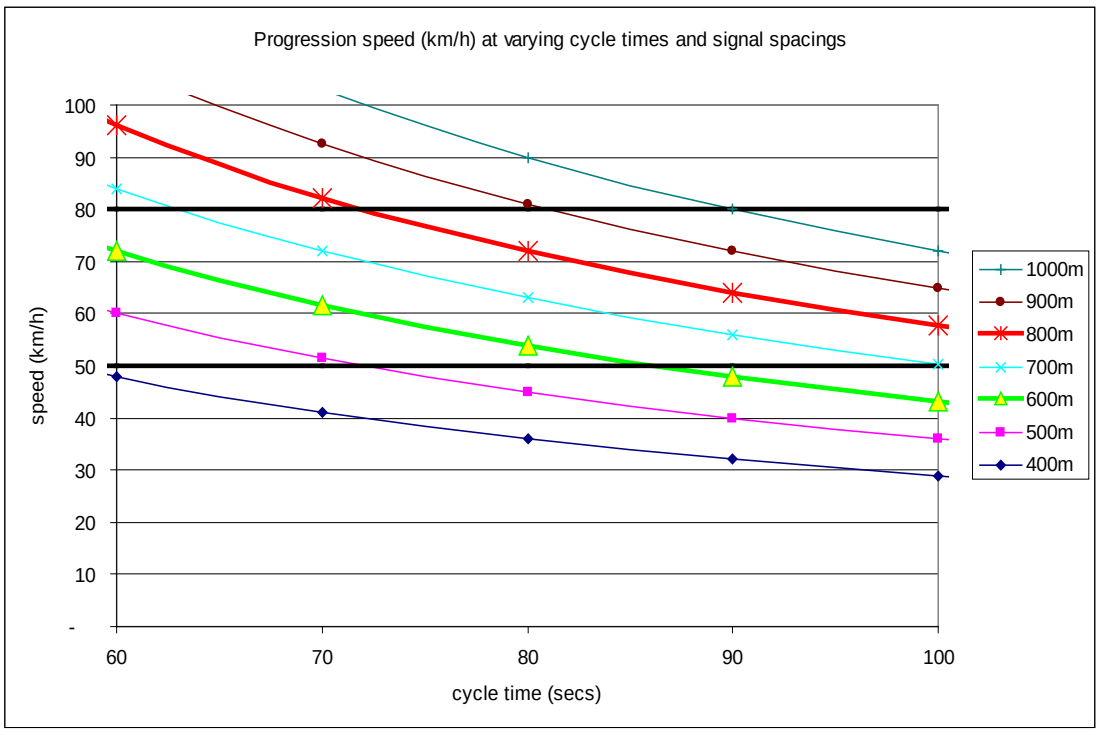

Figure 1: Progression speed at varying cycle times and signal spacings

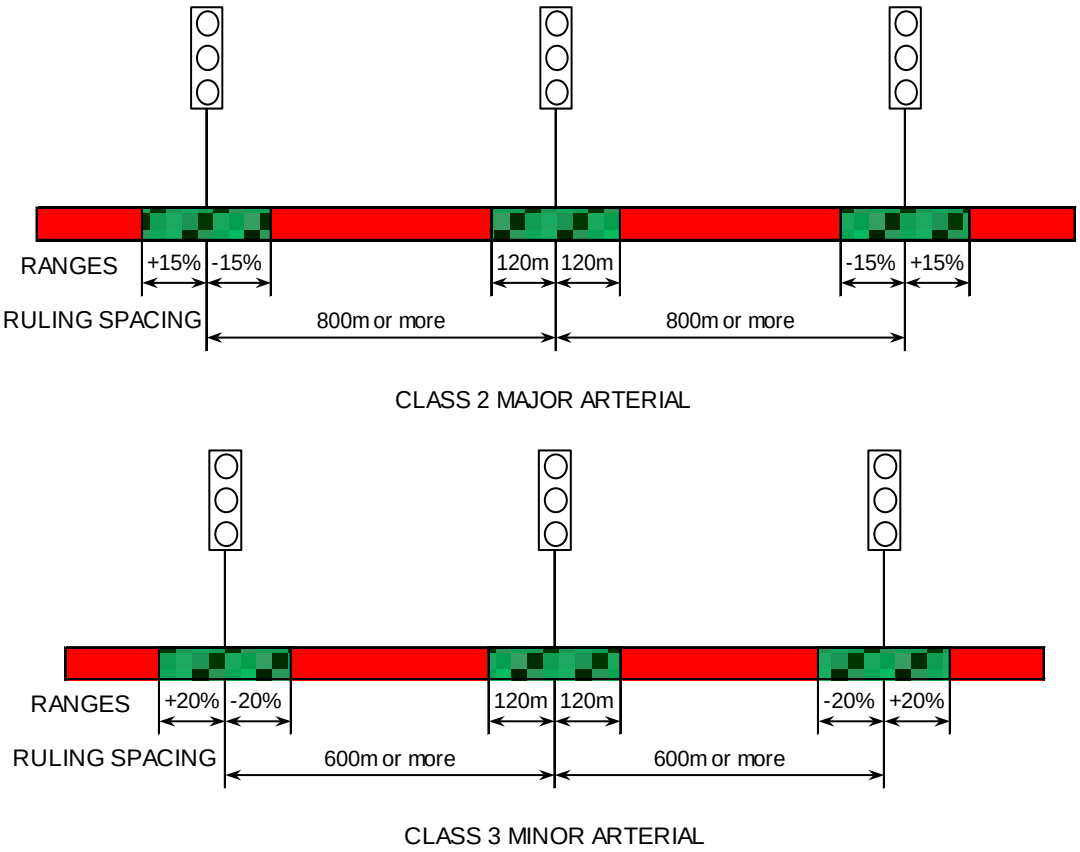

Figure 2: Range of Permitted Signal Spacings on Class 2 and 3 Roads

Figure 2 illustrates the principle that a signal can be placed within 120 m on either side of the ruling spacing (800 m or more on Class 2 roads and 600 m or more on Class 3 roads). This allowance is provided a reasonable percentage of green time (not less than half the cycle) is available to the main road.

The ruling spacing is the “average” spacing between signals or groups of signals along an arterial. For example, if five signals are set out over a distance of 2 500 m, the ruling spacing is 625 m (2500/4). The three signals between the outer two can be at a spaced at 625 m +/- 20% (Class 3), or 125 m on either side of the 625 m ruling spacing and still comply with the spacing requirement.

The 800 m / 600 m applies to signalized and unsignalized intersections. No differentiation between the types of control is made as no matter how minor the cross street may appear to be currently, there is no guarantee that conditions may not change sufficiently to warrant traffic signals in future.

Table A1: Classification by South African authorities (fitted into the RCAM six class system)

Function	Class.No	South Africa											
		RCAM 2010 (this manual) [COTO 2010]	RISFSA [DOT 2006]	National guidelines for road access management [COTO 2005]	RISFSA [DOT 2002]	Guidelines for Human Settlement [DOH 2000]	Road access policy [Prov. Admin. Western Cape 2000]	Typical SA and international access standards [Jeffares & Green 1999]	Road access policy [Prov. Admin. Western Cape 1996]	Pavement management systems TRH22 [CSRA 1994]	Urban transport guidelines (UTG) [CUTA 1986]	Guidelines for township roads [SAICE 1976]	Guidelines for engineering services in residential townships [DCD 1983 NHB 1995]
Mobility (arterial)	1	Principal arterial	Primary distributor	Principal arterial	1 Principal avenue of communication (central government)	Vehicle only route	High order arterial, primary / principal movement	Freeway, motorway, expressway, highway, national road, trunk road, primary level road, PWV route (Gauteng)	1 Primary movement	Level 1 Primary (national mobility)		Freeway	1 Trunk road, national and regional distributor (predominantly rural)
	2	Major arterial	Regional distributor	Major arterial	2 Avenue of communication (provincial government)			Major arterial, secondary roads, primary distributors, prov road, super street, principal / strategic / primary arterial, highway, K road	2 Transition	Level 2 Secondary (regional mobility)	Arterial (UTG1)	Major arterial	2 Primary distributor (major arterial)
	3	Minor arterial	District distributor	Minor arterial / activity arterial - spine	3 Principal arteries (metropolitan government)	Mixed pedestrian and vehicle route	District distribution, integration, collection	Minor arterial, tertiary route, link road, district distributor, main road	3 Distribution	Level 3 Tertiary (magisterial district mobility)		Minor arterial	3 District distributor (minor arterial)
Access / activity (street)	4	Collector street *(4a commercial, 4b residential)*	District collector	Activity street	4 Inter-municipal and industrial (district municipality)		Local distribution, integration, collection	Collector, major / minor collector, local distributor, street, high street, busway, connector, activity spine, district road, rural secondary road	4 Collection	Level 4 Tertiary (local access)	Collector (UTG15)	Major / minor collector	4 Local distributor
	5	Local street *(5a commercial, 5b residential)*	Access roads	Residential street	5 Collect and distribute local traffic (local municipality), 6 Access to rural settlements, 7 special purpose roads (recreation, forestry)		Individual property access via access collectors, loops, cul-de-sacs etc.	Street, local street, access street, local residential street, residential road, rural tertiary road, rural access road	5 Access		Local street (UTG7&10)	Local street, local collector, loop, link, cul-de-sac, access way, access court, panhandle	5 Residential access road, a) residential access collector b) residential access loop c) access cul-de-sac d) access way e) access court f) access strip
	6	Walkway *(6a pedestrian priority, 6b pedestrian only)*	Non-motorized access ways	Non-motorized	Non-motorized access ways	Pedestrian only route		Pedestrian priority / pedestrian (only) street, parking lot, pedestrian walk, mall, woonerf, path	6 Termination				

Table A2: Road Classification by various international authorities (fitted into the SA six class system)

Function	Class No	South Africa	USA					International		
		RCAM 2010 (this manual) [COTO 2010]	Highway functional classification [AASHTO 1964, FHA 1989]	Policy on geometric design of highways and streets [AASHTO 1973, 2004]	Transportation and land development [ITE 1988, NCHRP 1992]	Access management manual (State) [TRB 2003]	Access management manual (Local) [TRB 2003]	Great Britain ordnance survey [DfT, HA]	Australia	New Zealand
Mobility (arterial)	1	Principal arterial	Principal arterial system, interstate	Principal arterial system, interstate	Freeway, expressway	1 Interstate highways and other freeways	1 Freeway	Motorway, trunk roads	Freeway, M-route, state road, national highway	National road
	2	Major arterial	Principal arterial system, other	Principal arterial system, other	Strategic arterial, principal arterial, primary arterial	2 Roadway of statewide importance (strategic, principal arterials)	2 Major arterial	A-road, principal road	Major arterial, A-route, regional road	Primary (regional) arterial
	3	Minor arterial	Minor arterial road-street system	Minor arterial road-street system	Secondary arterial	3 Roadway of regional importance (other arterials)	3 Minor arterial	B-road	Minor arterial, B-route, district road, sub-arterial	Secondary (district) arterial
Access / activity (street)	4	Collector street *(4a commercial, 4b residential)*	Collector road-street system, major and minor collector roads	Collector road-street system, major and minor collector roads	Collector	4 District roadway (collector)	4 Major collector, 5 Minor collector	C-road, minor roads	Collector, C-route	Collector road
	5	Local street *5a commercial, 5b residential)*	Local road-street system	Local road-street system	Local, cul-de-sac	5 Local	6 Local	Local street, alley, private road with or without public access	Local, lane	Local road
	6	Walkway *(6a pedestrian priority, 6b pedestrian only)*	Terminal and transfer facilities	Terminal and transfer facilities				Pedestrianized street with restricted access		

Table B: Rural Functional Road Classification

Function			Description		Mobility				
Basic Function	Alternate functional descriptions	Determining function	Class No (R_)	Class name	Origin / destination	Through traffic component	Reach of connectivity	% of built km	AADT (average annual daily traffic)
Mobility	Vehicle priority, vehicle only, long distance, through, high order, high speed, numbered, commercial, economic, strategic; route, arterial road or highway.	Movement is dominant, through traffic is dominant, the majority of traffic does not originate or terminate in the immediate vicinity, the function of the road is to carry high volumes of traffic between urban areas	1	Principal arterial*	Metro areas, large cities, large border posts, join national routes	Exclusively	> 50 km	2 - 4% Classes 1 and 2	1000 – 100 000+
			2	Major arterial*	Cities and large towns, transport nodes (harbours and international airports), smaller border posts, join major routes	Exclusively	>25 km		500 – 25 000+
			3	Minor arterial*	Towns, villages and rural settlements, tourist destinations, transport nodes (railway sidings, seaports, landing strips), small border posts, other routes	Predominant	> 10 km	6 - 12% Classes 1, 2 and 3	100 – 2 000+
Access / Activity	Access, mixed pedestrian and vehicle traffic, short distance, low order, lower speed, community / farm, road or street.	Access, turning and crossing movements are allowed, the majority of traffic has an origin or destination in the district, the function of the road is to provide a safe environment for vehicles and pedestrians using access points	4	Collector road	Connect farming districts, rural settlements, tourist areas, national and private parks and mines to mobility routes	Minimal	< 10 km	20 - 25%	< 1 000
			5	Local road	Farm or property access, connection to other routes	Nil Discontinuous	< 5 km	65 - 75%	< 500
			6	Walkway (path or track)	Settlements, farms, transport nodes, water points	n/a			

** In rural areas, the term distributor may be preferred to arterial*

Table C: Urban Functional Road Classification

Function			Description		Mobility				Traffic	
Basic Function	Alternate functional descriptions	Determining function	Class No (U_)	Class name	Through traffic component	Distance between parallel roads (km)	% of built km	Reach of Connectivity	Expected range of ADT (average daily traffic)	% of travel veh-km
Mobility	vehicle priority, vehicle only, long distance, through, high order, high speed, numbered, commercial, economic, strategic; route, arterial road or highway.	Movement is dominant, through traffic is dominant, the majority of traffic does not originate or terminate in the immediate vicinity, the function of the road is to carry high volumes of traffic between urban districts	1	Principal arterial (freeway)	Exclusively	5 - 10 km	5 - 10% Classes U1 and U2	> 20 km	40 000 - 120 000+	40 – 65% Classes U1 and U2
			2	Major arterial	Predominant	1.5 - 5.0 km		> 10 km	20 000 - 60 000	
			3	Minor arterial	Major	0.8 - 2.0 km	15 - 25% Classes U1, U2 and U3	> 2 km	10 000 - 40 000	65 – 80% Classes U1, U2 and U3
Access / Activity	Access, mixed pedestrian and vehicle traffic, short distance, low order, low speed, community, street.	Access, turning and crossing movements are allowed, the majority of traffic has an origin or destination in the immediate area, the function of the road is to provide a safe environment for vehicles and pedestrians using access points	4a	Collector street, commercial	Discourage		5 – 10%	< 2 to 3 km	< 25 000	5 – 10%
			4b	Collector street, residential	Discourage			< 2 km	< 10 000	
			5a	Local street, commercial	Prevent		65 – 80%	< 1 km	< 5 000	10 – 30%
			5b	Local street, residential	Prevent			< 0.5 km (1 km Max)	< 1 000	
			6a	Walkway, pedestrian priority	Ban					
			6b	Walkway, pedestrian only	Ban					

Table D: Rural Access Management Requirements and Features

Basic Function	Description		REQUIREMENTS				TYPICAL FEATURES (use appropriate context sensitive standards for design)								
	Class No (R_)	Class name	Design typology	Route no.	Access to property	Parking	Speed km/h	Inter-section control	Typical cross section	Roadway / lane width	Road reserve width	Public transport stops and ped. xing.	Pedestrian footways (con-structed)	Cycle lanes	Animal drawn vehicles
Mobility	1	Principal arterial	Expressway	Yes (N)	Not allowed*	No (off road rest stops allowed)	120	Grade separate or priority to through	2 / 3 / 4 lane, surfaced shoulders, climbing lanes	3.5 - 3.7 m	60 - 80 m (62 m)	No	No	No	No
	2	Major arterial	Highway	Yes (R: 2 or 3-digit; or N)	Not allowed*/**	No (off road rest stops allowed)	120	Priority or grade separate	2 / 3 lane, surfaced shoulders, climbing lanes	3.5 - 3.7 m	40 - 70 m (48 m)	As required	Isolated	Recreational on shoulder	No
	3	Minor arterial	Main road	Yes (R: 3 or 2-digit)	Not allowed*/**	No (off road rest stops allowed)	100-120	Priority, roundabout	2 lane surfaced, gravel shoulders	4.0 m	30 - 50 m (30 m)	As required	Isolated	Recreational widen roadway both sides	Widen shoulder
Access / Activity	4	Collector road	Collector	Allowed, T (tourist) or D (district)	Yes	No (off road edge or in lay-byes / viewpoints)	80 -100	Priority	2 lane surfaced or gravel, gravel shoulders	3.5 m	25 m	As required	Rare, isolated	Widen roadway	Widen shoulder
	5	Local road	Farm road	Allowed, T (tourist) or L (local)	Yes	No (on verge or shoulder)	60 - 80	Priority	1 / 2 lane gravel, 600 mm concrete strips in environmental areas		20 m	As required	Rare	Use roadway	Use roadway
	6	Walkway	Track or pathway	No	Yes	n/a							Not constructed, formed by use		

** Access to properties sufficiently large to warrant a private intersection / interchange can be considered if access spacing requirement met and there is no future need for a public road.*

*** Low volume farm gate and tourist access (less than 10 vehicles per day) can be considered if no alternative exists.*

Table E: Urban Access Management Requirements and Features

Basic Function	Description		REQUIREMENTS					TYPICAL FEATURES (use appropriate context sensitive standards for design)								
	Class No (U_)	Class name	Design typology	Route no.	Intersection spacing	Access to property	Parking	Speed km/h	Inter-section control	Typical cross section	Roadway / lane width	Road reserve width	Public transport stops and ped. xing.	Pedestrian footways (constructed)	Cycle lanes	Traffic Calming
Mobility	1	Principal arterial	Freeway	Yes (M/R/N)	2,4 km (1.6 km - 3.6 km)	not allowed	No	100-120	Interchange	4 / 6 / 8 lane freeway	3.3 - 3.7 m lanes	60 - 120 m (60 m)	No	No	No	No
	2	Major arterial	Highway	Yes (M/R)	800 m (± 15%)	Not allowed*/**	No	80	Co-ordinated traffic signal, Interchange	4 / 6 lane divided, kerbed	3.3 - 3.6 m lanes	38 - 62 m (40 m)	Yes at inter-sections	Off road	Yes – widen roadway	No
	3	Minor arterial	Main road	Yes (M)	600 m (± 20%)	Not allowed*/**	No	70	Co-ordinated traffic signal, roundabout	4 lane divided or undivided, kerbed	3.3 - 3.5 m lanes	25 - 40 m (30 m)	Yes at inter-sections	Yes	Yes – widen roadway	No
Access / Activity	4a	Collector street, commercial	Commercial major collector	No (A for temp. routing)	> 150 m	Yes (larger properties)	Yes if conditions allow	60	Traffic signal, roundabout or priority	4 lane, median at ped. xing., boulevard, CBD one-way		20 - 40 m (25 m)	Yes at inter-sections or mid block	Yes	Yes, widen road or on verge	Median for peds, curved roadway
	4b	Collector street, residential	Residential minor collector	No	> 150 m	Yes	Yes if appropriate	50	Roundabout, mini-circle or priority	2 / 3 lane undivided	6 - 9m roadway, < 3.3 m lanes	16 - 30 m (20 m)	Yes anywhere	Yes	Yes, on road or verge	Raised ped, median, narrow lanes
	5a	Local street, commercial	Commercial access street	No		Yes	Yes if conditions allow	40	Priority	2 lane plus parking		15 – 25 m (22 m)	If applicable, anywhere	Normally yes	Use roadway	Raised ped. crossing
	5b	Local street, residential	Local residential street	No		Yes	Yes on verge	40	Mini-circle, priority or none	1 / 2 lane mountable kerbs	3.0 - 5.5 m roadway (two way)	10 - 16 m (14 m)	If applicable, anywhere	Not normally, pedestrians can use roadway	Use roadway	Yes, but should not be necessary
	6a	Walkway, non-motorized priority	Pedestrian priority	No	500 m maximum	Yes	Yes if parking lot or woonerf	15	None, pedestrians have right of way	Surfaced			If applicable, anywhere	Yes or use roadway	Rare	Yes
	6b	Walkway, non-motorized only	Pedestrian only	No	500 m maximum	Yes	No vehicles	peds. 80 m / minute	None, pedestrian signal	Block paving		6 m		Yes	Yes	

** Access to properties sufficiently large to warrant a private intersection / interchange can be considered if access spacing requirement met and there is no future need for a public road.*

*** Partial and marginal access at reduced spacing allowed to relieve congestion, reduce excessive travel distances or remove the need for a full intersection*

Municipal Population Statistics

Source: Stats SA

Population	2007 Estimate	2010 Estimate	Old Name	Province
JHB: City of Johannesburg	3888180	4276998		
CPT: City of Cape Town Metropolitan Municipality	3497097	3846807		
ETH: eThekwini Metropolitan Municipality	3468086	3814895		
EKU: Ekurhuleni Metropolitan Municipality	2724229	2996652		
TSH: City of Tshwane Metropolitan Municipality	2345908	2580499		
NMA: Nelson Mandela Bay Metropolitan Municipality	1050930	1156023		
FS172: Mangaung Local Municipality	752906	828197	Bloemfontein	Free State
EC125: Buffalo City Local Municipality	724312	796743	East London	Eastern Cape
GT421: Emfuleni Local Municipality	650867	715954	Vereeniging	Gauteng
KZN225: The Msunduzi Local Municipality	616730	678403	Pietermaritzburg	KwaZulu-Natal
LIM343: Thulamela Local Municipality	602819	663101	Thohoyandou	Limpopo
LIM354: Polokwane Local Municipality	561772	617949	Pietersburg/Polokwane	Limpopo
MP322: Mbombela Local Municipality	527203	579923	Nelspruit	Mpumalanga
MP325: Bushbuckridge Local Municipality	509970	560967		
LIM344: Makhado Local Municipality	471805	518986	Louis Trichardt	Limpopo
NW373: Rustenburg Local Municipality	449776	494754	Rustenburg	North West
EC157: King Sabata Dalindyebo Local Municipality	444830	489313	Umtata	Eastern Cape
MP312: Emalahleni Local Municipality	435217	478739	Witbank	Mpumalanga
FS184: Matjhabeng Local Municipality	405031	445534	Welkom	Free State
NW403: City of Matlosana	385782	424360		
FS194: Maluti a Phofung Local Municipality	385413	423954	Qwa-Qwa	Free State
NW372: Local Municipality of Madibeng	371197	408317	Brits	North West
LIM333: Greater Tzaneen Local Municipality	349087	383996	Tzaneen	Limpopo
LIM475: Greater Tubatse Local Municipality	343468	377815		
MP324: Nkomazi Local Municipality	338095	371905	Nkomazi	Mpumalanga
KZN282: uMhlathuze Local Municipality	332156	365372	Richards Bay	KwaZulu-Natal
LIM367: Mogalakwena Local Municipality	330649	363714	Potgietersrus	Limpopo
KZN252: Newcastle Local Municipality	327637	360401	Newcastle	KwaZulu-Natal
GT481: Mogale City Local Municipality	319641	351605	Krugersdorp	Gauteng
EC155: Nyandeni Local Municipality	314273	345700	Libode	Eastern Cape
EC122: Mnquma Local Municipality	297663	327429	Butterworth	Eastern Cape
NW383: Mafikeng Local Municipality	290229	319252	Mafikeng	North West
EC153: Qaukeni Local Municipality	279795	307775	Flagstaff (Ingquza Hill)	Eastern Cape
EC151: Mbizana Local Municipality	279739	307713	Bizana	Eastern Cape
MP315: Thembisile Local Municipality	278517	306369	KwaMhlanga	Mpumalanga
MP307: Govan Mbeki Local Municipality	268954	295849	Highveld Ridge	Mpumalanga
LIM473: Makhuduthamaga Local Municipality	262726	288999		
EC121: Mbhashe Local Municipality	262008	288209	Idutywa	Eastern Cape
EC441: Matatiele Local Municipality	258758	284634		
LIM332: Greater Letaba Local Municipality	247739	272513	Duiwelskloof	Limpopo
LIM331: Greater Giyani Local Municipality	247657	272423	Giyani	Limpopo
KZN263: Abaqulusi Local Municipality	247628	272391		
LIM472: Elias Motsoaledi Local Municipality	247488	272237		
MP316: Dr JS Moroka Local Municipality	246969	271666		

Population	2007 Estimate	2010 Estimate	Old Name	Province
KZN265: Nongoma Local Municipality	244501	268951		
KZN435: Umzimkhulu Local Municipality	243242	267566	Umzimkulu	Eastern Cape
NC091: Sol Plaatjie Local Municipality	243018	267320	Kimberley	Northern Cape
LIM355: Lepele-Nkumpi Local Municipality	241414	265555	Lebowakgomo	Limpopo
EC156: Mhlontlo Local Municipality	237138	260852	Qumbu	Eastern Cape
KZN232: Emnambithi-Ladysmith Local Municipality	236748	260423	Ladysmith	KwaZulu-Natal
NW375: Moses Kotane Local Municipality	227426	250169	Mogwase	North West
KZN216: Hibiscus Coast Local Municipality	224281	246709	Port Shepstone	KwaZulu-Natal
EC442: Umzimvubu Local Municipality	220631	242694	Mount Ayliff	Eastern Cape
WC023: Drakenstein Local Municipality	217089	238798	Paarl	Western Cape
NW405: Merafong City Local Municipality	215865	237452		
EC134: Lukanji Local Municipality	208081	228889		
KZN272: Jozini Local Municipality	207250	227975	Mkuze	KwaZulu-Natal
WC024: Stellenbosch Local Municipality	200524	220576	Stellenbosch	Western Cape
NW384: Ditsobotla Local Municipality	200141	220155	Lichtenburg	North West
KZN266: Ulundi Local Municipality	197908	217699		
LIM351: Blouberg Local Municipality	194119	213531	Bochum/My Darling	Limpopo
MP301: Albert Luthuli Local Municipality	194083	213491	Elukwatini/Carolina	Mpumalanga
EC135: Intsika Yethu Local Municipality	185342	203876		
MP313: Steve Tshwete Local Municipality	182503	200753	Middelburg	Mpumalanga
NW371: Moretele Local Municipality	182414	200655	Temba	North West
KZN213: Umzumbe Local Municipality	176287	193916	Umzumbe	KwaZulu-Natal
KZN284: uMlalazi Local Municipality	175372	192909	Eshowe	KwaZulu-Natal
FS201: Moqhaka Local Municipality	170522	187574	Kroonstad	Free State
EC154: Port St Johns Local Municipality	165084	181592	Port St Johns	Eastern Cape
KZN242: Nquthu Local Municipality	164887	181376		
KZN271: Umhlabuyalingana Local Municipality	163694	180063	Emangusi	KwaZulu-Natal
KZN292: KwaDukuza Local Municipality	162055	178261		
KZN244: Msinga Local Municipality	161894	178083		
FS204: Metsimaholo Local Municipality	154658	170124	Sasolburg	Free State
KZN235: Okhahlamba Local Municipality	151441	166585	Bergville	KwaZulu-Natal
KZN274: Hlabisa Local Municipality	150557	165613		
LIM352: Aganang Local Municipality	145454	159999	Moletji/Matlala	Limpopo
NW394: Greater Taung Local Municipality	144817	159299	Reivilo	North West
EC152: Ntabankulu Local Municipality	141358	155494		
KZN236: Imbabazane Local Municipality	140745	154820		
KZN262: UPhongolo Local Municipality	137756	151532	Pongola	KwaZulu-Natal
WC044: George Local Municipality	136542	150196	George	Western Cape
EC137: Engcobo Local Municipality	135979	149577		
KZN293: Ndwedwe Local Municipality	134322	147754		
WC025: Breede Valley Local Municipality	134271	147698	Worcester	Western Cape
EC127: Nkonkobe Local Municipality	130100	143110	Alice	Eastern Cape
NW385: Ramotshere Moiloa Local Municipality	129304	142234	Zeerust	North West
KZN286: Nkandla Local Municipality	127451	140196		
LIM334: Ba-Phalaborwa Local Municipality	127308	140039	Phalaborwa	Limpopo
MP302: Msukaligwa Local Municipality	126268	138895		
EC136: Emalahleni Local Municipality	125293	137822	Witbank	Mpumalanga
LIM471: Greater Marble Hall Local Municipality	124510	136961		
NW402: Potchefstroom Local Municipality	124351	136786	Potchefstroom	North West
EC141: Elundini Local Municipality	123636	136000	Mount Fletcher	Eastern Cape
KZN291: Mandeni Local Municipality	122665	134932		

Population	2007 Estimate	2010 Estimate	Old Name	Province
EC142: Senqu Local Municipality	118177	129995		
KZN281: Mbonambi Local Municipality	118081	129889		
WC043: Mossel Bay Local Municipality	117838	129622	Mossel Bay	Western Cape
GT482: Randfontein Local Municipality	117261	128987	Randfontein	Gauteng
KZN245: Umvoti Local Municipality	114509	125960	Greytown	KwaZulu-Natal
KZN431: Ingwe Local Municipality	114116	125528		
KZN221: uMshwathi Local Municipality	113054	124359		
EC124: Amahlathi Local Municipality	112735	124009		
LIM474: Fetakgomo Local Municipality	112232	123455	Fetakgomo	Limpopo
KZN294: Maphumulo Local Municipality	109157	120073	Maphumulo	KwaZulu-Natal
FS192: Dihlabeng Local Municipality	108449	119294	Bethlehem	Free State
LIM342: Mutale Local Municipality	108215	119037	Mutale-Masisi	Limpopo
MP303: Mkhondo Local Municipality	106452	117097	Piet Retief	Mpumalanga
KZN214: UMuziwabantu Local Municipality	104527	114980	Harding	KwaZulu-Natal
GT462: Kungwini Local Municipality	104149	114564		
FS191: Setsoto Local Municipality	102826	113109		
KZN233: Indaka Local Municipality	101557	111713		
NC083: //Khara Hais Local Municipality	100920	111012		
LIM353: Molemole Local Municipality	100408	110449	Dendron/Dikgale	Limpopo
GT483: Westonaria Local Municipality	99218	109140	Westonaria	Gauteng
NW381: Ratlou Local Municipality	98104	107914	Setlagole	North West
LIM335: Maruleng Local Municipality	95779	105357	Hoedspruit	Limpopo
FS203: Ngwathe Local Municipality	95187	104706	Parys	Free State
KZN283: Ntambanana Local Municipality	94190	103609	Ntambanana	KwaZulu-Natal
FS185: Nala Local Municipality	92586	101845	Bothaville	Free State
KZN254: Dannhauser Local Municipality	91366	100503	Durnacol	KwaZulu-Natal
MP305: Lekwa Local Municipality	91136	100250	Standerton	Mpumalanga
MP321: Thaba Chweu Local Municipality	87545	96300	Sabie	Mpumalanga
NW404: Maquassi Hills Local Municipality	87465	96212	Wolmaransstad	North West
WC031: Theewaterskloof Local Municipality	86719	95391	Caledon	Western Cape
KZN222: uMngeni Local Municipality	84781	93259	Howick	KwaZulu-Natal
KZN234: Umtshezi Local Municipality	83906	92297	Estcourt	KwaZulu-Natal
GT422: Midvaal Local Municipality	83445	91790	Meyerton	Gauteng
EC126: Ngqushwa Local Municipality	83086	91395		
NW382: Tswaing Local Municipality	81005	89106		
KZN434: Ubuhlebezwe Local Municipality	80905	88996		
LIM362: Lephalale Local Municipality	80141	88155	Ellisras	Limpopo
WC026: Breede River/Winelands Local Municipality	80121	88133	Robertson	Western Cape
FS181: Masilonyana Local Municipality	80094	88103	Theunissen	Free State
WC045: Oudtshoorn Local Municipality	79606	87567	Oudtshoorn	Western Cape
WC014: Saldanha Bay Local Municipality	78982	86880	West Coast Peninsula	Western Cape
WC015: Swartland Local Municipality	77524	85276	Malmesbury	Western Cape
NW391: Kagisano Local Municipality	75946	83541		
WC022: Witzenberg Local Municipality	75148	82663		
KZN261: eDumbe Local Municipality	75096	82606		
WC032: Overstrand Local Municipality	74547	82002		
KZN212: Umdoni Local Municipality	74437	81881	Scottburgh	KwaZulu-Natal
KZN211: Vulamehlo Local Municipality	74017	81419		
EC108: Kouga Local Municipality	73274	80601	Humansdorp	Eastern Cape
EC104: Makana Local Municipality	70059	77065	Grahamstown	Eastern Cape
NC451: Moshaweng Local Municipality	70012	77013		

Population	2007 Estimate	2010 Estimate	Old Name	Province
NC452: Ga-Segonyana Local Municipality	69791	76770		
GT423: Lesedi Local Municipality	66507	73158	Heidelberg	Gauteng
MP304: Seme Local Municipality	65932	72525		
WC048: Knysna Local Municipality	65045	71550	Knysna	Western Cape
FS193: Nketoana Local Municipality	62367	68604	Reitz	Free State
MP323: Umjindi Local Municipality	60475	66523		
LIM361: Thabazimbi Local Municipality	60039	66043	Thabazimbi	Limpopo
FS173: Mantsopa Local Municipality	59028	64931	Ladybrand	Free State
NW392: Naledi Local Municipality	57934	63727	Vryburg	North West
LIM341: Musina Local Municipality	57195	62915	Messina	Limpopo
KZN227: Richmond Local Municipality	56772	62449	Richmond	KwaZulu-Natal
NC082: Kai !Garib Local Municipality	56501	62151		
KZN215: Ezingoleni Local Municipality	56369	62006		
LIM366: Bela-Bela Local Municipality	55844	61428		
NC062: Nama Khoi Local Municipality	54644	60108	Springbok	Northern Cape
KZN241: Endumeni Local Municipality	54447	59892	Dundee	KwaZulu-Natal
FS205: Mafube Local Municipality	53722	59094	Frankfort	Free State
EC138: Sakhisizwe Local Municipality	53472	58819		
LIM365: Modimolle Local Municipality	52602	57862	Nylstroom	Limpopo
MP311: Delmas Local Municipality	50455	55501	Delmas	Mpumalanga
FS162: Kopanong Local Municipality	49422	54364	Trompsburg	Free State
GT461: Nokeng tsa Taemane Local Municipality	49389	54328	Cullinan	Gauteng
EC131: Inxuba Yethemba Local Municipality	48399	53239	Cradock	Eastern Cape
KZN285: Mthonjaneni Local Municipality	47010	51711		
KZN433: Greater Kokstad Local Municipality	46724	51396	Kokstad	KwaZulu-Natal
KZN275: Mtubatuba Local Municipality	46596	51256	Mtubatuba	KwaZulu-Natal
KZN226: Mkhambathini Local Municipality	46570	51227	Camperdown	KwaZulu-Natal
NC094: Phokwane Local Municipality	46409	51050		
WC011: Matzikama Local Municipality	46362	50998	Vredendal	Western Cape
EC105: Ndlambe Local Municipality	46359	50995	Port Alfred	Eastern Cape
WC013: Bergrivier Local Municipality	44741	49215		
EC143: Maletswai Local Municipality	42843	47127	Aliwal North	Eastern Cape
FS163: Mohokare Local Municipality	41867	46054	Zastron	Free State
EC101: Camdeboo Local Municipality	41758	45934	Graaff-Reinet	Eastern Cape
EC109: Kou-Kamma Local Municipality	40780	44858	Kareedouw	Eastern Cape
NC092: Dikgatlong Local Municipality	40752	44827	Barkley West	Northern Cape
FS183: Tswelopele Local Municipality	40617	44679	Hoopstad	Free State
KZN224: Impendle Local Municipality	39401	43341		
WC042: Hessequa Local Municipality	39081	42989	Langeberg Local Municipality	Western Cape
WC047: Bitou Local Municipality	39002	42902	Greater Plettenberg Bay	Western Cape
NC073: Emthanjeni Local Municipality	38228	42051		
MP306: Dipaleseng Local Municipality	37873	41660	Balfour	Mpumalanga
NW374: Kgetlengrivier Local Municipality	37806	41587		
WC053: Beaufort West Local Municipality	37090	40799	Beaufort West	Western Cape
NW393: Mamusa Local Municipality	36533	40186	Schweizer-Reneke	North West
NW401: Ventersdorp Local Municipality	36528	40181	Ventersdorp	North West
NC078: Siyancuma Local Municipality	35970	39567	Griekwastad	Northern Cape
FS195: Phumelela Local Municipality	35090	38599	Vrede	Free State
KZN273: The Big Five False Bay Local Municipality	34991	38490	Hluhluwe	KwaZulu-Natal
EC106: Sunday's River Valley Local Municipality	34935	38429	Kirkwood	Eastern Cape

Population	2007 Estimate	2010 Estimate	Old Name	Province
EC123: Great Kei Local Municipality	33382	36720	Komga	Eastern Cape
MP314: Emakhazeni Local Municipality	32840	36124		
NW396: Lekwa-Teemane Local Municipality	32809	36090	Christiana	North West
WC012: Cederberg Local Municipality	31942	35136	Citrusdal	Western Cape
KZN223: Mpofana Local Municipality	31518	34670		
WC033: Cape Agulhas Local Municipality	28444	31288		
NC453: Gamagara Local Municipality	28054	30859	Kathu	Northern Cape
NC085: Tsantsabane Local Municipality	28005	30806	Postmasburg	Northern Cape
EC132: Tsolwana Local Municipality	27660	30426	Tarkastad	Eastern Cape
EC102: Blue Crane Route Local Municipality	25573	28130	Somerset East	Eastern Cape
FS171: Naledi Local Municipality	25442	27986	Vryburg	North West
WC041: Kannaland Local Municipality	24715	27187		
EC144: Gariep Local Municipality	23708	26079	Burgersdorp	Eastern Cape
KZN253: Emadlangeni Local Municipality	23263	25589		
WC034: Swellendam Local Municipality	22833	25116	Barrydale/Swellendam	Western Cape
NC072: Umsobomvu Local Municipality	21992	24191	Colesberg	Northern Cape
NC086: Kgatelopele Local Municipality	21498	23648	Danielskuil	Northern Cape
EC128: Nxuba Local Municipality	21467	23614		
FS182: Tokologo Local Municipality	21323	23455	Dealesville	Free State
NC065: Hantam Local Municipality	21234	23357	Calvinia	Northern Cape
NC093: Magareng Local Municipality	20433	22476	Warrenton	Northern Cape
NC077: Siyathemba Local Municipality	20120	22132	Prieska	Northern Cape
NC084: !Kheis Local Municipality	18920	20812	Groblershoop	Northern Cape
LIM364: Mookgopong Local Municipality	16818	18500	Naboomspruit	Limpopo
NC071: Ubuntu Local Municipality	16153	17768	Victoria West	Northern Cape
NC061: Richtersveld Local Municipality	14613	16074	Port Nolloth	Northern Cape
EC133: Inkwanca Local Municipality	14283	15711	Molteno	Eastern Cape
KZN432: Kwa Sani Local Municipality	14281	15709		
EC107: Baviaans Local Municipality	13950	15345		
NC076: Thembelihle Local Municipality	13218	14540	Hopetown	Northern Cape
NC067: Khai-Ma Local Municipality	12571	13828	Pofadder	Northern Cape
NC064: Kamiesberg Local Municipality	12117	13329	Garies	Northern Cape
EC103: Ikwezi Local Municipality	11523	12675		
NC066: Karoo Hoogland Local Municipality	10420	11462	Fraserburg	Northern Cape
NC074: Kareeberg Local Municipality	9866	10853	Carnarvon	Northern Cape
NC075: Renosterberg Local Municipality	9185	10104	Phillipstown	Northern Cape
WC052: Prince Albert Local Municipality	8374	9211		
NC081: Mier Local Municipality	7337	8071		
NW395: Molopo Local Municipality	6516	7168		
WC051: Laingsburg Local Municipality	5156	5672		