1. INTRODUCTION

1.1. Purpose of these guidelines.

This document has been prepared in response to the need to lay down minimum standards for Township Developments within the City of Cape Town.

The objectives of the document are:

- To give guidance to where relevant specifications and guidelines can be found.
- Highlight and in some instances repeat important aspects of such relevant documentation.
- Lay down minimum specifications relevant to the City’s needs.
- Make designers aware of the City’s adopted policies.
- To strive towards uniformity in terms of design criteria and material specifications.

This document will be available to all developers and consultants as a quick guide to assist with the design and construction of urban infrastructure. The vision is to expand the document in future to include all services in one easily distributable and concise document.

Any discrepancies which become apparent must be referred to the Director: Roads and Stormwater (hereinafter referred to as “D:R&S”). In such cases the more restrictive requirements shall apply, unless otherwise approved by the D:R&S.

1.2. Applicability

These Standards are applicable to all residential, industrial and commercial township developments in the City of Cape Town, with the exception of low-cost government subsidised developments, where other standards may be used by prior agreement with the Director: R&S.

1.3. Deviations

Where existing infrastructure and site specific conditions require deviation from this document such deviations must be approved by the D:R&S.

1.4. Site Specific Conditions and Future Developments

Where abnormal site conditions exist or where a development needs to service existing or future developments the D:R&S may require a higher standard of the services to be provided.

Special or unique design situations must be addressed on a case by case basis.

1.5. Design Approval

The approval of the design by the D:R&S in no way absolves the developer from any responsibilities or liabilities in respect of the design.

2. CONTENTS LIST

The following list includes the Section headings for all the chapters of this document.

[include automatically updating list here]

3. ROAD PLANNING

3.1. General

This section of the guidelines covers primarily local streets up to Class 3 roads. The Directorate of Transport Planning should be consulted for the planning and design of Class 2, Primary Distributor Roads.
Road Planning cannot be seen in isolation by the Engineering profession but must be dealt with in close cooperation with the Town Planners.

The planning process needs to respond to the following inputs:

- Environment
- Community it needs to serve
- Modes of Transport
- Public Transport needs
- Integration with Public Transport network
- Recreational and Community facilities

Priority should be given to the needs of transport modes in the following order of precedence:

- Walking
- Cycling
- Public Transport (that includes mini-bus taxis)
- Commercial Vehicles
- Private Cars

3.2. Relevant codes of practice, policies and guidelines [add publisher, date for each]

- Guidelines for Human Settlement Planning and Design (“Red Book”)
- City of Cape Town Zoning Scheme Regulations, Fourth Draft, November 2007
- UTG 1: Geometric Design of Urban Arterials
- UTG 5: Geometric Design of Urban Collector Roads
- UTG 7: Geometric design of Local Residential Streets.
- UTG 10: Guidelines for the Geometric Design of Commercial and Industrial Local Streets.
- TGS 1,5,9,12,14 (Transport Planning Guidelines )

3.3. Town Planning

3.3.1. Access to Properties

Access restrictions on properties need to be established at the planning stage and the rules need to be incorporated in Overlay Zone regulations applicable to a particular area or land unit.

3.3.2. On Site Parking Requirements

The provision for on site parking is covered in Chapter 19 and in a number of other sections of the City of Cape Town Zoning Scheme Regulations.

3.3.3. Setbacks for Garages, Carports and Security Gates

The minimum required building line setback as prescribed in the City of Cape Town Zoning Scheme Regulations must be adhered to at all times. Any relaxation of the street building line needs to be approved by the D:R&S.

It is recommended that the street building line for garages or carports be applied as follows:

<table>
<thead>
<tr>
<th>Building Line Setback for Garages and Carports.</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-site parking in terms of the Zoning Scheme</td>
</tr>
<tr>
<td>Provision only in front of garage or carport</td>
</tr>
<tr>
<td>Provision elsewhere on site</td>
</tr>
<tr>
<td>None Required (Low cost housing projects)</td>
</tr>
</tbody>
</table>

- In cases where dedicated pedestrian or cycle lanes exist or where a high volume of pedestrian traffic is expected, the minimum distance of 5.5m shall be measured from the back of such lanes or paths in order not to interfere with pedestrian or bicycle movements.
• On roads with high vehicular traffic (typical middle and higher order links) it should be a requirement that all security gates be set back 5.5 m from the road kerb line or pedestrian and cycle lane. Such requirements can be enforced as part of the plans approval process for boundary walls.

3.3.4. Setbacks for Access Gates at ‘High Generator’ Driveways

The stacking space in front of access gates to developments shall be as follows, measured from the edge of the closest lane or shoulder or footway or cycle lane as applicable:

<table>
<thead>
<tr>
<th>No. of units served</th>
<th>Required Stacking Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 15</td>
<td>6m</td>
</tr>
<tr>
<td>15 – 40</td>
<td>12m</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>Site Specific Requirements</td>
</tr>
</tbody>
</table>

3.3.5. Gates: general requirements

3.3.5.1. No part of any gate shall be installed within road reserves. Gates on a boundary must be completely on the private side thereof.

3.3.5.2. Gates shall not open into road reserves, but inwards away from the road. Gates opening towards the road must be set back so that the open gate is completely outside the road reserve.

3.3.5.3. The location of gate control devices within the road reserve is not supported.

3.3.5.4. No part of a gate’s mechanism may be accessible from the road reserve. Suitable protection must be in place where necessary.

Also refer to Guidelines for Sliding Gates, Director: Roads and Stormwater, 1995-08-08

3.4. Road Planning Standards

3.4.1. Road Classification and Hierarchy

Designers should read these Minimum Standards in conjunction with Chapters 5 and 7 of the Red Book [use the formal name] where the emphasis is on Movement Networks rather than the conventional hierarchical structure. Designs should be based on the functions that each Link within a Movement Network needs to perform to determine the appropriate road reserve widths, footway and on-street parking provisions. Innovation should be the key principle rather than merely opting for the minimum standard solution.

3.4.2. Design Speed

At a Road planning stage it is important to establish whether the design standards for a given speed can be maintained within the chosen road layout. Steep terrains require special attention from a road planning perspective. (See later in this document.)

Residential streets should also be designed such that speed control and extraneous traffic control is inherent in the layout. “Add-on” measures such as speed humps are not favoured.

3.4.3. Road Reserve Characteristics

The cross section of the road reserve must provide for all functions that the road is expected to fulfill, including:

- safe and efficient movement of all users,
- provision for parked vehicles,
- provision for utility services both under and above ground,
- street lighting
- landscaping
- traffic signs and signals
- street name and direction signs.

In addition to the above the selected roadway and road reserve should comply with the following:

- The safety and convenience of pedestrians and cyclists must be ensured by providing sufficient on or off road paths or sidewalks.
- The roadway width must allow for vehicles to proceed safely at the operating speed intended for the class of road.
• The road reserve width should be sufficient to provide adequate access to individual erven. The word “adequate” must be read in context with the mode of transport that is expected to dominate each specific road or pedestrian access way.

• Widening of the roadway and road reserve may be required at strategic locations to allow for wider heavy vehicle paths.

• Widening of the verge and subsequent road reserve may be required to ensure adequate sight distances around horizontal curves and at intersections. The use of mirrors to ameliorate sight line problems is not allowed.

• Appropriate verge width must be provided to enable the safe location, construction and maintenance of required utility services e.g. electricity, water, telecommunication, street lighting. See Section 3 on Road Verges, for more information.

3.4.4. Parking

Provision for parking shall form an inherent part of any new development. It is important that vehicles should not be parked within sight triangles at intersections or bends. Designers should consider the provision of on or off street parking in conjunction with other issues such as driveway access, waste collection etc. In developments with narrow frontages parking on-street may be problematic and setbacks of entrances and garages need to be considered to avoid parking back-up into the street system.

Property owners adjoining roadways should provide sufficient on-site or off street parking as per the guidelines as set out by the Department of Transport or the City of Cape Town Zoning Scheme Regulations, whichever is most applicable. The minimum recommended parking requirement for single residential erven is as follows:

<table>
<thead>
<tr>
<th>Income Group</th>
<th>Parking Spaces (Includes garage and carport)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>4</td>
</tr>
<tr>
<td>Medium</td>
<td>3</td>
</tr>
<tr>
<td>Low</td>
<td>2</td>
</tr>
<tr>
<td>State Subsidised</td>
<td>1</td>
</tr>
</tbody>
</table>

The trend nowadays is to install security fencing on property boundaries. In order to accommodate a parked vehicle in front of a tip up door, garage set backs should not be less than 6.5m.

Provision for on-street parking should be considered at the following locations:

- At Public Amenities
- Along Local and District Distributor roads, especially in low cost housing developments.

In low cost residential areas on-street parking promotes economic development. Another advantage is that it stops “informal structures creep” onto the roadway thereby keeping the reserve width clear which enhances sight distance. Pedestrians also make use of this area extensively. Where pedestrian traffic is expected to be high, a V-channel arrangement to separate the parking from the roadway is recommended. To illustrate this a typical example can be seen on the photographs below.
3.4.5. Waste Collection

A consideration for waste collection is one of the most important aspects in the planning of any new development. Road layouts and reserve widths should be designed to accommodate typical waste collection vehicles. Designs should be based on the SU type vehicle as specified in Table 7.2 of the Red Book.

Refuse vehicles generally do not enter pedestrian only routes and short cul-de-sacs unless these roadways are designed for such vehicles with ample provision for turning.

In Low Cost Housing developments large turning circles are generally not affordable. In such cases collection points need to be provided adjacent to the roadway at the nearest passing point. As rule the distance from the collection point to the furthest service point should not be more than 45m.

A typical collection point can consist of a demarcated and surfaced or paved area behind the road kerb, at least 1.5m wide with a length equal to the number of service points in meters. Such collection areas should be carefully selected to avoid being too close to or opposite residential frontages or accesses, and to ensure that sight lines for road users are not obstructed.

3.4.6. Public Transport

On designated bus routes (or potential bus routes) provision needs to be made for bus facilities including bus stops, shelters and bus embayments. Such provisions should include consideration for pedestrian access, driveway locations and geometric design at intersections.

Street networks should be planned to bring everyone within a convenient walking distance (not more than 400m) of public transport stops, especially in low cost housing areas. See chapter 8.4 of the Road Access Guidelines for the optimal location and minimum guidelines for bus and minibus taxi stops.

The minimum roadway (surfaced) width for bus routes shall be 7.4m.

Bus stops in bus bay: Dimensions should be as shown on plan …. Locating the bus stop so that the entry or exit end coincides with an intersection, a carriageway crossing or a no parking zone, may save space.

Bus stops in the driving lane (on low order roads only): Where space is not available for a full bus bay and the stopping time is short, a bus stop in the traffic lane may be considered. In this case a minimum length of 12m must still be reserved and marked on the road.

3.4.7. Intersections

Street layouts must be planned for maximum safety. The aim should be to minimize the number of intersections required for any township development. Skewed intersections must be avoided and in no case should the angle be less than 70°.

The provision of vehicle access close to intersections and roundabouts needs to be carefully examined. Operational and safety considerations may warrant restrictions on access.

Land uses that generate large volumes of traffic should have access points well away from intersections.

3.4.8. Traffic Control at Intersections

Intersections where a reasonable [more than 50 vehicles per hour?] volume of traffic is expected need to be analysed at design stage to establish the type of control measure to be implemented. Roundabouts are in many cases preferred to signalised intersections because of the inherent safety and efficiency benefits, and lower maintenance cost.

Roundabouts are also excellent traffic calming measures especially if these form part of an overall traffic calming plan.

Three or four way stop control at busy intersections is not acceptable, and should also be avoided at minor intersections.

3.4.9. Traffic Calming
Streets must be designed in such a way that traffic calming is a natural result, and the requirement for “add-on” measures is obviated. This can be achieved by reducing block lengths as far as possible and by avoiding unnecessary through routes. On collector roads speed reducing measures such as roundabouts and pedestrian crossings with median islands could form part of an inherent traffic calming strategy.

### 3.4.10. Road Widening for Recreational Purposes (“Woonerf” Concept)

In low order and pedestrian only links in low cost housing areas, road designs should allow for road widening at convenient locations to allow space for recreational purposes within the road reserve. These areas can typically be in the middle of a “super block” or opposite an entry or exit point to a Pedestrian Only Link. It typically needs to perform one or more of the following functions:

- Creational purposes (children’s play area),
- Refuse collection (wheelie bin or black bag storage space),
- Turning space for vehicles,
- Parking space for visitors.

These areas should be large enough to have the necessary impact. Widening shall not be less than 3m per road reserve side and the entire area shall be surfaced. The widened areas may be in contrasting paving.

### 3.4.11. Fences, Guardrails and Bollards

Urban streets are not provided with fences. Where these exist, they are part of the abutting land, and should therefore not be located on the road side of the road reserve boundary.

Guardrails within the road reserve for the sole purpose of protecting anything else than legitimate road users shall not be permitted.

The use of bollards to control vehicular movements is not supported.

Refer to “Advisory Note Regarding the Erection of Guardrails and Other Barriers” approved by the Dir:TR&S on 2004-01-29.

### 3.4.12. Street Name Signs

Street name signs can be either on pole mounted name plates or on kerbs. In each case the detail as shown on plans must be used. Exceptions will only be allowed in special cases, at the discretion of the D:R&S. Not that free standing street name kerbs are not favoured, but where these are unavoidable, they should be situated against the road reserve boundary.

House numbers may be displayed on kerbs, subject to ???

Street names shall comply with the City’s Street Naming, Renaming and Numbering policy.

### 3.5. Cross Section Requirements

Recommended minimum standards are given in the tables below for the different classes of roadways:

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed (higher order)</td>
<td>Table 1.5.1</td>
</tr>
<tr>
<td>Mixed (middle order)</td>
<td>Table 1.5.2</td>
</tr>
<tr>
<td>Mixed (lower order)</td>
<td>Table 1.5.3</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>Table 1.5.4</td>
</tr>
</tbody>
</table>

The vertical clearance required over all portions of the road reserve accessible to vehicles is as stated below (Geometric Design of Urban Arterial Roads Manual (UTG 1) of 1986):

"The standard minimum vertical clearance from any point in a roadway to an overhead structure is 5.1 m.

If the structure is light such as a pedestrian overpass, then the vertical clearance required is 5.5 m or more.

Future overlays must be taken into account when determining clearances."
• Direct property access is not recommended.

MIXED (higher-order) LINK DISTRICT DISTRIBUTOR

<table>
<thead>
<tr>
<th>Income Groups</th>
<th>High/Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Reserve Width (m)</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Roadway Width (m blacktop)</td>
<td>2 x 3.4m Lanes/direction with 5.0m Median</td>
<td>2 x 3.4m Lanes/direction with 5.0m Median</td>
</tr>
<tr>
<td>Parking Arrangement (m blacktop)</td>
<td>1 x 2.5m Lanes/direction/Combination Parking/Cycle lane</td>
<td>1 x 2.5m Lanes/direction/Combination Parking/Cycle lane</td>
</tr>
<tr>
<td>Verge Width (m)</td>
<td>7.9</td>
<td>7.9</td>
</tr>
<tr>
<td>Kerb Type</td>
<td>BK2 / BK4</td>
<td>BK2 / BK4</td>
</tr>
<tr>
<td>Crossfall/ Camber</td>
<td>Camber</td>
<td>Camber</td>
</tr>
</tbody>
</table>

MIXED (middle-order) LINK (Class 4, LOCAL DISTRIBUTOR)

<table>
<thead>
<tr>
<th>Income Groups</th>
<th>High/Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Reserve Width (m)</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Roadway Width</td>
<td>2 x 3.7m lanes (black top)</td>
<td>2 x 3.7m lanes (black top)</td>
</tr>
<tr>
<td>Parking Arrangement</td>
<td>2 x 2.5m Combination Parking/Cycle lane</td>
<td>2 x 2.5m * Combination Parking/Cycle lane</td>
</tr>
<tr>
<td>Verge Width (m)</td>
<td>3.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Kerb Type</td>
<td>BK2</td>
<td>BK2 #</td>
</tr>
<tr>
<td>Crossfall/ Camber</td>
<td>Camber</td>
<td>Camber</td>
</tr>
<tr>
<td>Minimum Erf Splay Dimensions at Intersections</td>
<td>5 x 5</td>
<td>5 x 5</td>
</tr>
</tbody>
</table>

• * For low cost housing areas the Parking/Cycle lane shall be separated from the roadway by means of a V-Channel arrangement.
• # For low cost housing areas with narrow frontages MK10 kerbs may be used along parking embayment to facilitate vehicular access.
### MIXED (lower- order) LINK
( Class 5, ACCESS STREET )

<table>
<thead>
<tr>
<th>Income Groups</th>
<th>High/Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate conditions Volume/Speed</td>
<td>L M H</td>
<td>L M H</td>
</tr>
<tr>
<td>Road Reserve Width (m)</td>
<td>10 12 14</td>
<td>8 10 12</td>
</tr>
<tr>
<td>Roadway Width (Backtop) (m)</td>
<td>5.0 5.5 6.0</td>
<td>4.5 5.0 5.5</td>
</tr>
<tr>
<td>Verge Width (Kerb face to erf line) (m)</td>
<td>2.30 3.05 3.80</td>
<td>1.65 2.40 3.05</td>
</tr>
<tr>
<td>Maximum Length (m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kerb Type</td>
<td>CK5 CK5 CK5</td>
<td>CK5/M K10 CK5/ MK10 CK5</td>
</tr>
<tr>
<td>Crossfall(CF)/ Camber(CA)</td>
<td>CA CA CA</td>
<td>CF CF CA</td>
</tr>
<tr>
<td>Minimum Erf Splay Dimensions at Intersections</td>
<td>3.5 x 3.5 x 4.5</td>
<td>3.5 x 3.5 x 4.5</td>
</tr>
</tbody>
</table>
Limited Vehicular ownership.
- Restricted vehicular access.
- No kerbed entrance (bell mouth) from adjoining roadways. Roadways and pedestrian links to be separated by kerbs.
- To be accessible for Emergency and Service Vehicles
- No through traffic allowed
- Ensure that multi-directional pedestrian circulation
- No turning area necessary
- Allow widening for recreational purposes (Woonerf Concept)
4. ROAD DESIGN

4.1. General

This section of the guidelines covers primarily local streets up to Class 3 roads. The Director: Transport shall be consulted for the geometric design of higher order roads.

The Red Book [use formal name], Chapter 7: Geometric Design and Layout Planning, gives a detailed coverage of the geometric design for roads. Other documentation as described below can be referred to for items not covered in the Red Book [.,].

- For Roundabouts reference should be made to Chapter 6 of ‘Roundabouts: An Informational Guide’ from the Turner Fairbank Highway Research Centre, which exhaustively covers all the basic elements of geometric design. (Requires adaptations for South African use).

4.2. Relevant codes of practice, policy and guidelines

- Guidelines for Human Settlement Planning and Design, Chapter 7
- UTG 1: Geometric Design of Urban Arterials
- UTG 5: Geometric Design of Urban Collector Roads
- UTG 7: Geometric design of Local Residential Streets.
- UTG 10: Guidelines for the Geometric Design of Commercial and Industrial Local Streets.

4.3. Road Design

4.3.1. At Grade Intersections

The following basic criteria for intersections shall apply:

- Intersecting roads should where possible meet at 90°. Skewed intersections must be avoided and in no case shall the angle of intersection be less than 70°.
• Intersections shall preferably not be positioned in or near horizontal curves of small radii, on the inside of any horizontal curves or on or close to sharp crests. Safe shoulder sight distance shall be the deciding criterion.

• The maximum grade for approach legs to an intersection is 5%, for a minimum distance of 20m from the edge of the intersection. Normally the grade of the major road should be carried through. A maximum grade of 3% to 4% for intersections is recommended.

• All turning movements shall be checked for compliance with the swept path of the design vehicle applicable to the intersection.

• Even where mountable kerbs are used along roads, the kerbs around intersection corners shall always be non-mountable.

• For radii less than 10 m, short kerbs shall be used. In all other cases long kerbs must be used.

4.3.2. Curve Radii

Minimum curve radii shall preferably be as follows:

<table>
<thead>
<tr>
<th>Road Category</th>
<th>Bellmouth Radii (m)</th>
<th>Horizontal inside Curve Radii (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed (higher order) Link (District Distributor)</td>
<td>10</td>
<td>350</td>
</tr>
<tr>
<td>Mixed (middle order) Link (Class 4, Local Distributor)</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>Mixed (lower order) Link (Class 5, Access Collector)</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>Mixed (lower order) Link (Class 5, Access Street)</td>
<td>6</td>
<td>35</td>
</tr>
</tbody>
</table>

4.3.3. Roundabouts

Roundabouts shall be classified as follows:

<table>
<thead>
<tr>
<th>Roundabout types</th>
<th>Design Vehicle Red Book Table7.2</th>
<th>Design Speed</th>
<th>Inscribed Diameter(ICD)(m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini Roundabout Mixed (middle order) Link</td>
<td>Single unit truck (SU)</td>
<td>25</td>
<td>13 – 25</td>
</tr>
<tr>
<td>Urban Compact Mixed (middle order) Link</td>
<td>SU and BUS</td>
<td>30</td>
<td>25 – 30</td>
</tr>
<tr>
<td>Urban Single Lane Mixed (higher order) Link</td>
<td>Semi-trailer (WB15)</td>
<td>35</td>
<td>30 – 40</td>
</tr>
<tr>
<td>Urban Double Lane Mixed (higher order) Link</td>
<td>Semi-trailer (WB15)</td>
<td>35</td>
<td>45 – 55</td>
</tr>
</tbody>
</table>

Roundabouts need to be designed for site specific and traffic conditions. In order to create some uniformity within the City the following is prescribed:

• The kerbing used on the perimeter of roundabouts shall generally be Barrier Kerbs (BK2 or BK4). For Mini Roundabouts on Lower Order Links the kerb type may match the kerbing used on the major approaching road.

• The physical layout and size of the central island will determine the amount of deflection that is imposed on the through vehicle. A mountable apron may have to be added to achieve the desired deflection in order to reduce vehicular speed.

• Barrier kerbs (BK2 or BK4) to be used for splitter islands. Where splitter islands are small and where no pedestrian crossings are envisaged, Semi Mountable Kerbs (MK2 or MK10) may be considered.
• The minimum width for splitter islands at pedestrian crossing points shall be 1.8 m, set back at least one vehicle length (6.0 m) from the entrance line with provision for dropped kerbs for wheelchairs and prams. Tactile warning surfaces shall be provided at all pedestrian crossings – see plans for details.

• Central islands which vehicles are not supposed to traverse shall have semi mountable kerbs (MK2).

• Where an apron is required a special mountable kerb (MK11) shall separate the apron from the circulatory roadway with a height difference of approximately 75 mm.

• Central and splitter islands shall have paved surfaces and kerbs painted black and white alternately to clearly distinguish the islands from the roadway.

5. ROAD VERGES

5.1. General

The verge needs to perform a number of functions including:

• Providing space for under and above ground services.
• Providing space for street furniture items such as bus shelters etc.
• Provide for the safe movement of pedestrians and cyclists where applicable.
• Provide for off-street parking where required.
• Provide for adequate sight distance around curves and at intersections.
• Provide space for landscaping
• Provide space for overland stormwater drainage.

The verge width should therefore be sufficient to incorporate the above functions.

In low cost housing areas where windblown sand is a problem, all verges shall be provided with a 1.5 m wide x 75 mm thick (compacted thickness) gravel wearing surface on both sides of the road.

Stones (of any size) on verges and islands shall not be allowed.

5.2. Relevant codes of practice, policy and guidelines [add publishers and dates]

• Guidelines for Human Settlement Planning and Design (Red Book)
• UTG 5: Geometric Design of Urban Collector Roads
• UTG 7: Geometric design of Local Residential Streets.
• UTG 10: Guidelines for the Geometric Design of Commercial and Industrial Local Streets.

5.3. Verge Cross Section

Factors that determine the verge cross section are:

• A cross slope of not less than 1% is required for surface drainage
• The verge cross fall shall not exceed 17%, unless suitably designed measures (retaining structures, landscaping, surface hardening) are taken to ensure the stability and functionality of the verge.
• The back of footway level shall be sufficiently higher than the top of kerb to ensure that overland stormwater flow stays within the road prism.
• An area of approximately 1.5 m wide is required immediately adjacent to kerb with a maximum cross slope of 3% towards the kerb to allow (i) the safe passage of pedestrians and cyclists, (ii) to allow wheel bin placement and (iii) to allow driveway access without vehicles scraping.

5.4. Underground Service Reservations

5.4.1. Stormwater Drainage

Preferably Stormwater pipelines should be located underneath the roadway, or in steep terrain on the high side behind the kerb line, if possible. The minimum reservation width is the outside diameter of the pipe plus 800 mm. For deep pipes and poor ground conditions this may be increased.
5.4.2. Sewer Drainage

Sewer pipes should preferably be located under the centerline of the roadway, or slightly offset on cambered roads. In steep sloping terrain sewer lines should, if possible, be located on the high side of the road reserve, underneath the roadway, which permits relatively short connections. The minimum reservation width is 1000 mm.

5.4.3. Watermains

Watermains should be located on the high side of the road reserve to ensure that in the event of a burst watermain flooding of properties is minimized. The minimum reservation width is 700 mm, or the pipe diameter plus 600 mm for pipes up to 300 mm in diameter. Watermains should preferably not be located below surfaced footways or underneath roadways to ensure easy access for maintenance and water connections and disconnections.

5.4.4. Electricity and Telecommunication Services

5.4.4.1. General Requirements

It is generally preferred that Electrical and Telecommunication Services be installed on opposite sides of the road reserve, especially in the case of high voltage electrical cables. The minimum reservation width is 1000 mm for both services with a clearance from the property boundary of 400 mm for Telecommunication cables and a minimum of 500 mm for Electrical services.

Overhead Telecommunication and Electrical poles shall generally be located as close as possible to the property boundary with a minimum clearance of 300 mm.

5.4.4.2. Manholes

All telecommunication and electrical manholes, whether these are in the roadway or not, must be designed to withstand traffic loading and they must have a chimney of at least 300 mm between the manhole lid and the top of the roof slab. A 300 mm chimney allows some flexibility should an adjustment or widening be needed to the road levels. It also provides for at reasonable layer works over the roof slab and minimises the likelihood of reflective cracking caused by differential settlement.

5.4.5. Subsoil Drains

Subsoil drains, where required, should preferably be installed on the high side of the road reserve directly behind the kerb line.

5.4.6. Curved Road Reserves

Services along curved alignments, particularly those which need to be laid in a series of straights (Sewer and Stormwater lines), may require additional space and the road reserve should be widened where necessary.

5.5. Above Ground Service Reservations

5.5.1. Electrical Plant and Street Lighting

Where street lighting is mounted on separate poles the minimum clear space between the pole and roadway shall be as follows:

| Roadway clearance for Street Lighting Poles. (Measured from back of kerb to face of pole) |
|---------------------------------------------|-------------------------------------|------|
| Barrier Kerb BK2 and BK4                     | Next to parking bay or shoulder     | 0.30m|
| Barrier Kerb BK2 and BK4                     | Next to Traffic Lane                | 2.0m |
| Mountable Kerb CK5 and MK10                  | Next to parking bay                 | 0.30m|
| Mountable Kerb CK5 and MK10                  | Next to Traffic Lane                | 2.0m |

Streetlights, power poles, substations and electrical kiosks should be placed clear of future driveways, and preferably opposite common erf boundaries.

5.5.2. Clear Space for Landscaping
In township layouts where the planting of large trees along roads form part of the development a reservation width of at least 1200 mm should be allowed.

It is generally accepted that the care and maintenance of the verge surfaces be carried out by the adjacent land owners and that no special reservation be made for the planting of trees and shrubs. Trees and shrubs that obstruct sight lines may be removed or trimmed by Council.

Attention is drawn to the City’s Tree Policy (Council, 2002-11-01) which, inter alia, regulates the planting of trees in road reserves, and provides guidance with respect to positioning of trees in relation to utility services.

6. Pedestrian and Cycle ways

6.1. Non Motorised Transport

This section sets out specific requirements for the design of pedestrian and cycle facilities that should form part of any new development. Cognisance shall be taken of the Director: Transport’s NMT policy and Chapter 13 of the Integrated Transport Plan.

Surfaced footways shall be provided along roadways where pedestrian traffic is expected to be high, e.g. at churches, schools, public amenities, commercial areas, and along main routes.

Appropriate pedestrian crossing points at schools, community amenities, opposite expected pathways, at busy intersections and at places of attraction needs to form part of any development proposal. These crossings together with other measures such as roundabouts should form part of a built-in traffic calming strategy.

A satisfactory level of service should be provided that include users with disabilities and those with limited mobility.

The provision of these facilities should be such that it encourages the use of these modes of transport.

6.2. Relevant codes of practice, policy and guidelines

- CoCT: TR&S : Guideline 01 : Provision of Vehicular Access Crossings
- Guidelines for Human Settlement Planning and Design (Red Book)
- Pedestrian and Bicycle Facility Guidelines. Department of Transport, August 2003)

6.3. Pedestrian and Cycle Way Design

6.3.1. Footway and Cycle Lane Widths

The minimum width for surfaced pedestrian paths and cycle lanes shall be as follows:

<table>
<thead>
<tr>
<th>Prescribed Footway/ Cycle lane width.</th>
<th>Usage</th>
<th>Minimum Width (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Type</td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Anticipated Volume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed (lower order) Link</td>
<td>Pedestrian</td>
<td>2.0</td>
</tr>
<tr>
<td>Mixed (middle order) Link</td>
<td>Pedestrian</td>
<td>2.0</td>
</tr>
<tr>
<td>Mixed (middle order) Link</td>
<td>Pedestrian/Cyclists</td>
<td>3.0</td>
</tr>
<tr>
<td>Mixed (higher order) Link</td>
<td>Pedestrian</td>
<td>2.5</td>
</tr>
<tr>
<td>Mixed (higher order) Link</td>
<td>Pedestrian/Cyclists</td>
<td>3.0</td>
</tr>
</tbody>
</table>

6.3.2. Road Crossings

Designers should note the safety and operational issues that arise where pedestrians and cycling routes cross certain types of intersections or roadways.

- At major signalised intersections footpaths and cycle ways should preferably be combined to one crossing point with special pedestrian and cycle phases provided for.
• Provision must be made for pedestrian and cycle crossing points in the splitter islands at roundabouts.

• On-road cycling at multi lane roundabouts should not be allowed.

• Where a pedestrian road crossing is provided with a median island (for refuge and traffic calming purposes), the width of the island shall be at least 2.0 m and barrier kerbed all round. The median island (kerbed section) shall be at least 30 m long with appropriate painted tapers and barrier lines on either side to prevent vehicles from overtaking on the wrong side of the road.

6.3.3. Tactile Warning Surfaces

Tactile warning surfaces to accommodate blind and weak-sighted persons shall be installed at all pedestrian crossing points, splitter and median islands, and shall meet the following requirements:

• The tactile surface shall consist of raised truncated domes with a nominal diameter of 23 mm, a height of 5 mm and a center to center spacing of 60 mm.

• The tactile surface shall contrast visually with adjoining surfaces, either light-on-dark or dark-on-light.

• Tactile surfaces shall be placed behind the kerb line (dropped kerb) and extend into the pedestrian refuge area a distance of 990 mm. On narrow median and splitter islands the tactile surface shall be reduced to 660 mm with a contrasting section of normal paving surfacing inbetween.

• The width of tactile surface shall equal the dropped kerb length with a minimum width of 990 mm.

See typical plan for details of concrete tactile slabs.

7. Driveways

7.1. General

Driveways (also known as carriageway crossings) must be constructed where vehicles are crossing over the footway or verge in order to enter private property from a road having a non mountable kerb, kerb and channel, or dish channel in front of the property.

In designing driveways the primary consideration must be the safety of all users, especially pedestrians and cyclists on pathways and traffic on the road from which access is gained.

A driveway (or carriageway crossing) is an encroachment of vehicular traffic across a pedestrian way, and not the other way around, and the design thereof should convey this principle. Driveways with kerb arrangements which make these resemble normal road intersections are therefore not favoured. Refer to Plan .......

Driveways should be designed to allow vehicles to enter the site by turning at slow speed from the traffic lane nearest to the site without intruding into other traffic lanes, especially on higher order roads. Where two-way traffic is expected the driveway should be of sufficient width to allow two vehicles to pass to avoid queuing on public roads.

Driveways should be designed for the most common vehicle that will be using them. The following table can be used as a guide:

<table>
<thead>
<tr>
<th>TYPE OF SURFACE</th>
<th>BITUMINOUS PREMIX (ASPHALT)</th>
<th>CLAY BRICK OR CONCRETE BLOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF CROSSING</td>
<td>PEDESTRIAN</td>
<td>CARRIAGeway</td>
</tr>
<tr>
<td>DUTY OF CROSSING</td>
<td>LIGHT</td>
<td>HEAVY</td>
</tr>
<tr>
<td>USAGE OF CROSSING</td>
<td>Pedestrian only</td>
<td>Single residential</td>
</tr>
</tbody>
</table>
### TYPE OF EDGING

<table>
<thead>
<tr>
<th></th>
<th>Brick stretcher on edge or 150 x 75 mm precast concrete (side and boundary edging)</th>
<th>250 x 100 mm precast concrete (side and boundary edging)</th>
<th>250 x 100 mm precast concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>THICKNESS OF</strong></td>
<td>25 mm</td>
<td>25 mm</td>
<td>40 mm</td>
</tr>
<tr>
<td><strong>SAND BED THICKNESS</strong></td>
<td>nil</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td><strong>THICKNESS OF GRAVEL BASE COMPACTED</strong></td>
<td>(G5)*</td>
<td>75 mm</td>
<td>100 mm</td>
</tr>
<tr>
<td><strong>OVERALL DEPTH OF COMPACTED LAYERS AND OF EXCAVATION</strong></td>
<td>100 mm</td>
<td>125 mm</td>
<td>190 mm</td>
</tr>
<tr>
<td><strong>ADDITIONAL EXCAVATION WHERE CLAYEY MATERIAL IS ENCOUNTERED</strong></td>
<td>0 mm</td>
<td>150 mm</td>
<td>150 mm</td>
</tr>
</tbody>
</table>

* The standard for Subbase (G5) and Base (G3) shall be in accordance with the Technical Recommendations for Highways – TRH 14.
** 100% for sand.

The first 6m of a driveway from the back of footway may not be steeper than 5% up or down, except in the case of a single dwelling.

High volume driveways (generally all except those serving single residential properties) shall be designed with sufficient stacking length to avoid queuing in the public street.

#### 7.2. Relevant codes of practice, policy and guidelines [add publishers and dates.]

- CoCT: TR&S : Guideline 01 : Provision of Vehicular Access Crossings
- UTG 5: Geometric Design of Urban Collector Roads
- UTG 7: Geometric design of Local Residential Streets.
- UTG 10: Guidelines for the Geometric Design of Commercial and Industrial Local Streets.
- National Building Regulations ()

#### 7.3. Driveway Design

Reference should foremost be made to the City’s guidelines on driveways as detailed above.

#### 7.3.1. Design Parameters

Even if there is no surfaced footway the verge and driveway must still accommodate the movement of pedestrians and perform a drainage function. Design considerations are as follows:
• An area of approximately 1.5 m wide is required immediately adjacent to kerb with a maximum cross slope of 3% towards the kerb to allow (i) the safe passage of pedestrians and cyclists,(ii) to allow wheel bin placement and (iii) to allow driveway access without vehicles scraping.

• Ramps across drainage channels are not allowed. Where the shape of the road leaves no alternative, a ramp may be constructed which leaves the drainage channel open and accessible, as shown on plan …. (New – Access Ramps); in this case the alignment of the road must be carefully designed to avoid sudden changes.

• A cross slope of not less than 1% is required for surface drainage.

• Surfaces must be skid resistant, even when wet.

• A maximum gradient of 17% within the verge width.

• The back of footway level to be sufficiently higher than the top of kerb to ensure that overland flows stay within the road reserve.

• Distance from nearest intersection must comply with Road Access Guidelines.

• Access restrictions on certain classes or sections of road apply.

• Unobstructed sight lines must be maintained.

In determining gradients for a driveway, designers must apply the clearances of a typical South African Vehicle (as depicted in Figure 5.1 below) to the longitudinal section in order to avoid scraping.

8. Parking

8.1. General

This section covers some basic parking layout design guidelines. For a comprehensive guide to strategy and operational issues reference should be made to the City’s Parking Plan policy. [Is this the correct title?] For general parking requirements the documentation as listed below needs to be referred to.

For new commercial developments parking shall be provided in terms of Chapter 19, of the City of Cape Town Zoning Scheme Regulations.

Parking areas shall have a pavement structure for a class UD road as specified in Section 7 of this document. Areas which are also used by heavy vehicles (loading areas) shall have a pavement structure for a class UC (Major Bus Route) road.

8.2. Relevant codes of practice, policies and guidelines

Parking Plan (Parking Strategy and Operational Guideline) – City of Cape Town
Parking Standards – Department of Transport
8.3. Geometric Design

8.3.1. Angled Parking

The recommended dimensions for angled parking layouts are indicated in the table below. The dimensions referred to are those as given in Figure 6.3.1. [check the reference.]

<table>
<thead>
<tr>
<th>Parking Angle (ø)</th>
<th>Width (m)</th>
<th>Depth (m)</th>
<th>Aisle Width (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ideal</td>
</tr>
<tr>
<td>90°</td>
<td>2.5</td>
<td>5.0</td>
<td>7.5</td>
</tr>
<tr>
<td>60°</td>
<td>2.9</td>
<td>5.3</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.4</td>
</tr>
<tr>
<td>45°</td>
<td>3.5</td>
<td>4.9</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4.2</td>
</tr>
<tr>
<td>30°</td>
<td>5.0</td>
<td>4.2</td>
<td>3.5</td>
</tr>
</tbody>
</table>

- The absolute minimum values given in the table should be used with caution and in limited applications only, such as private parking areas.

8.3.2. Parallel Parking

For parallel parking the dimensions as given in Figure 6.3.2 shall apply. Along highly trafficked roads the clear space between two consecutive bays shall be increased to 1.5 m.
8.4. Parking Areas

8.4.1. Parking Layout

The parking layout recommended is 90° bays with two-way movement in aisles. Angled parking and one-way movements should generally be avoided. Parking layout must be such that all bays can be entered or left without difficult or potentially hazardous manoeuvres, such as long reversing paths, or difficult manoeuvres involving poles and columns. To achieve this additional clear space beyond end bays may be required to allow turning movements.

Kerbs shall be low enough to allow vehicle overhangs and easy opening of doors.

8.4.2. Safety

Car parks should be designed to provide a safe environment for its users. The design should minimize vehicle-to-vehicle and vehicle-to-pedestrian conflicts. Direct access via pedestrian paths to destinations should be provided. Adequate lighting should be provided.

8.4.3. Parking for Disabled Persons

Adequate parking provision, near end destinations, needs to be made for vehicles used by disabled people. Such parking bays shall be provided with a 1.5 m minimum width access aisle between vehicles to allow easy wheelchair access between parked vehicles.

Parking bays for disabled persons shall be clearly marked as prescribed by the SARTSM (R323-P).

8.4.4. Landscape Elements

Landscaping is an important element of a car park. A well-designed car park, shaded by trees, screened by hedges, shrubs or grassed mounds provides a stark relief from the expanses of a featureless paved area.

The following design principles should be adopted:

- Avoid stand alone trees planted within car park (hard) surfaces. Rather use groups of trees in special planting areas.

- Choose appropriate ground surfaces for open areas and around trees. These could include mulch, natural gravel, porous paving, groundcover plants and grass. Grassed surface areas should however not be steeper than 1:4. Loose stone beds are not an acceptable surfacing medium.
• Pedestrian routes need to be carefully planned, e.g. make provision for paths through garden beds etc. Vertical clearance of at least 2.2 m (2.5 m preferred) over the entire width of all pedestrian ways, and preferably over all areas accessible to pedestrians, is required.

• Co-ordinate surface lighting with tree planting

• No tree or shrub planting should take place where car overhang (up to 0.8 m from kerbs) is expected.

• Shrubs and trees shall be chosen to require minimal maintenance.

• Incorporate paved areas to break the surface texture and to provide color enhancements.


Attention is drawn to the City's Tree Policy (Council, 2002-11-01) which, inter alia, regulates the planting of trees in road reserves, and provides guidance with respect to positioning of trees in relation to utility services.

9. Pavement Design

9.1. General

Pavement design is a process of selecting appropriate pavement and surfacing layers to ensure that the pavement will carry the traffic for the structural design period, at an acceptable service level without any major structural distress.

Designers should base their design on a life cycle strategy comprising of high initial standards followed by very low or minimal maintenance needs over the analysis period.

In areas where mole or mole-rat activity is evident, and where open, unhardened space along a road is going to be a permanent or semi-permanent feature, the installation of mole barriers may be required to protect the road pavement layers. Materials used for mole barriers must be environmentally acceptable.

9.2. Relevant codes of practice, policy and guidelines

• Red Book – Guidelines for Human Settlement Planning and Design.
• TRH 4 – Structural Design of Flexible Pavements for Interurban and Rural Roads.
• TRH 14 – Guidelines for Road Construction Materials
• SABS 1200 M:1996 – Roads (general)
• SABS 1200 ME:1981 – Subbase
• SABS 1200 MF:1981 – Base
• SABS 1200 MFL:1996 – Base (Light Pavement Structures)
• SABS 1200 MH:1996 – Asphalt Base and Surfacing
• SABS 1200 MJ:1984 – Segmented Paving

9.3. Pavement Design

9.3.1. Level of Service

The level of service should be related to the function of the street. A higher order, or more important road, should have a higher level of service. Its physical properties and standards should be higher with a reduced risk of failure.

For all formal roads within the City of Cape Town a basic minimum level of service (LOS) of 5 as per Table 8.2 of the Red Book is required, unless such roadways forms part of interim measures where only rudimentary services are provided. Formal roadways with open lined storm water channels are generally not acceptable because of the windblown sand problems.

9.3.2. Minimum Pavement Design Guidelines

Where possible, designers must base their design on the estimated E80' over the design period. A minimum catalogue standard as given in Table 7.3.2 at the end of this section shall apply for categories UB, UC and UD roads as defined in chapter 8 of the Red Book, Table 8.1.
The structural design periods for all road categories shall be 20 years.

As a guideline pavement layers shall comply with the following minimum standard:

<table>
<thead>
<tr>
<th>ROAD CATEGORY</th>
<th>SURFACING</th>
<th>PAVEMENT LAYERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>UB (District Distributor)</td>
<td>40 mm medium continuously graded Asphalt</td>
<td>150mm G2 Basecourse 150mm C4 Cemented Subbase 150mm G7 Subgrade 150mm G9 Subgrade</td>
</tr>
<tr>
<td>UC (Major bus route)</td>
<td>40 mm medium continuously graded Asphalt</td>
<td>150mm G3 Basecourse 150mm C4 Cemented Subbase 150mm G7 Subgrade 150mm G9 Subgrade</td>
</tr>
<tr>
<td>UC (Minor bus route)</td>
<td>30 mm medium continuously graded Asphalt</td>
<td>150mm G4 Basecourse 150mm G5 Subbase 150mm G7 Subgrade 150mm G9 Subgrade</td>
</tr>
<tr>
<td>UD (Access Street)</td>
<td>30 mm medium continuously graded Asphalt</td>
<td>150mm G4 Basecourse 150mm G7 Subgrade</td>
</tr>
<tr>
<td>Pedestrian Only Links</td>
<td>25 mm medium continuously graded Asphalt</td>
<td>125mm G4 Basecourse 150mm G7 Subgrade</td>
</tr>
<tr>
<td>Sidewalks and Cycle Ways</td>
<td>20 mm medium continuously graded Asphalt</td>
<td>100mm G5 Basecourse 150mm G7 Subgrade</td>
</tr>
</tbody>
</table>

9.3.3. Subgrade CBR

The bearing capacity and quality of the in situ subgrade or fill material is very important in the selection of the appropriate pavement layers. Designers should conduct a proper soil survey to determine the in situ CBR within the material depth specified in Table 15 of TRH 4. The classification of the subgrade material shall be based on the soaked California Bearing Ratio (CBR) at 93% of Mod. AASHTO max. density (100% for sand).

9.3.4. Compaction Densities and Material Specifications

Pavement layers and material shall comply with the following:

<table>
<thead>
<tr>
<th>LAYER</th>
<th>CLASS</th>
<th>MATERIAL TYPE</th>
<th>MIN CBR AT SPEC. DENSITY</th>
<th>MAX PI</th>
<th>MIN COMPACTION</th>
<th>GRADING SABS-1200M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basecourse</td>
<td>G2</td>
<td>Crushed stone</td>
<td>80</td>
<td>6</td>
<td>85% BRD 98% Mod AASHTO 98% Mod AASHTO</td>
<td>Tbl 8, Column 2</td>
</tr>
<tr>
<td></td>
<td>G3</td>
<td>Crushed stone</td>
<td>80</td>
<td>6</td>
<td>95% Mod AASHTO</td>
<td>Tbl 8, Column 3</td>
</tr>
<tr>
<td></td>
<td>G4</td>
<td>Crushed stone</td>
<td>80</td>
<td>6</td>
<td>None specified</td>
<td>Tbl 8, Column 4</td>
</tr>
<tr>
<td>Subbase</td>
<td>G5</td>
<td>Crushed stone</td>
<td>45</td>
<td>6</td>
<td>95% Mod AASHTO</td>
<td>None specified</td>
</tr>
<tr>
<td>Selected layer (upper 300mm)</td>
<td>G7</td>
<td>In-situ or Imported sand</td>
<td>15</td>
<td>12</td>
<td>93% Mod AASHTO or 100% for sand</td>
<td>None specified</td>
</tr>
<tr>
<td>Subbase for sidewalks</td>
<td>Surfaced</td>
<td>Crushed Stone</td>
<td>45</td>
<td>6</td>
<td>95% Mod AASHTO</td>
<td>None specified</td>
</tr>
<tr>
<td></td>
<td>Unsurface d</td>
<td>Natural Gravel or Crushed Stone wearing course</td>
<td>45</td>
<td>6</td>
<td>95% Mod AASHTO</td>
<td>None specified</td>
</tr>
</tbody>
</table>

- Crushed rubble shall only be used in cases where the consistency of the material can be guaranteed and with special approval from the D:R&S. It shall further only be used in subbase or fill applications.
9.3.5. Surfacing Specifications and Densities

Bituminous surface treatments in the form of chip and spray, slurry or Cape Seals are not acceptable. All surfacing shall be in the form of continuous graded, hot asphalt, spread with a self-propelled mechanical spreader (paver).

Surfacing layers shall comply with the following:

<table>
<thead>
<tr>
<th>ROAD CATEGORY</th>
<th>SURFACING</th>
<th>MIN COMPACT</th>
<th>GRADING</th>
</tr>
</thead>
<tbody>
<tr>
<td>UB (District Distributor)</td>
<td>40 mm medium continuously graded Asphalt</td>
<td>92% Rice</td>
<td>COLTO Tbl 4202/7</td>
</tr>
<tr>
<td>UC (Major bus route)</td>
<td>40 mm medium continuously graded Asphalt</td>
<td>92% Rice</td>
<td>SABS 1200MH Tbl 2 Column 6</td>
</tr>
<tr>
<td>UC (Minor bus route)</td>
<td>40 mm medium continuously graded Asphalt</td>
<td>95% Marshall</td>
<td>SABS 1200MH Tbl 2 Column 6</td>
</tr>
<tr>
<td>UD (Access Street)</td>
<td>30 mm medium continuously graded Asphalt</td>
<td>95% Marshall</td>
<td>SABS 1200MH Tbl 2 Column 6</td>
</tr>
<tr>
<td>Pedestrian Only Links</td>
<td>25 mm medium continuously graded Asphalt</td>
<td>95% Marshall</td>
<td>SABS 1200MH Tbl 2 Column 7</td>
</tr>
<tr>
<td>Sidewalks and Cycle Ways</td>
<td>20 mm medium continuously graded Asphalt</td>
<td>95% Marshall</td>
<td>SABS 1200MH Tbl 2 Column 7</td>
</tr>
</tbody>
</table>

9.3.6. Compaction Equipment

Pavement layer compaction during construction has a major effect on the structural bearing capacity of the pavement. The higher the construction density of a layer, the higher the strength and hence the resistance to deformation.

Designers should therefore not only specify the minimum compaction rates but also the type of plant to be used for the different material types. For the compaction of base, subbase and subgrade (sand) layers a 9 ton vibratory roller should be regarded as the minimum requirement.

9.3.7. Labour Intensive Construction

On projects where labour intensive methods are specified, a critical review of the specifications for road pavement layers needs to be made. All road construction activities cannot be labour intensive. The activities that can be labour-based are the following:

- Excavation up to 1.5 m in depth, in material suitable for hand excavation.
- Spreading of homogeneous or coarse graded materials.
- Kerb laying and ancillary works

The construction methods chosen should obtain the same standard as the conventional methods. For labour intensive projects, segmented concrete block pavements or the use of Waterbound Macadam as a base layer for granular pavements is recommended.

9.3.8. Selected Layers

Designs for all categories of roads should assume that all subgrades are brought to at least equal (G7) support standard. Subgrade conditions that are below a G7 standard shall be treated as per Table 22 of TRH 4, or be replaced with suitable material.
<table>
<thead>
<tr>
<th>ES0.01</th>
<th>0.003 - 0.01</th>
<th>30mm AC</th>
<th>30mm AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ES0.03</th>
<th>0.01 - 0.03</th>
<th>30mm AC</th>
<th>30mm AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ES0.1</th>
<th>0.03 - 0.10</th>
<th>30mm AC</th>
<th>30mm AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ES0.3</th>
<th>0.10 - 0.30</th>
<th>30mm AC</th>
<th>30mm AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ES1</th>
<th>0.30 - 1.0</th>
<th>30mm AC</th>
<th>30mm AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ES3</th>
<th>1.0 - 3.0</th>
<th>40mm AC</th>
<th>40mm AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ES10</th>
<th>3.0 - 10.0</th>
<th>40mm AC</th>
<th>40mm AC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150mm G7</td>
<td>150mm G7</td>
</tr>
</tbody>
</table>
9.4. Additional requirements for steep terrains

9.4.1. General

The following additional requirements apply to all roads steeper than 1:8 (12.5%), unless otherwise specified.

Portions of private driveways which fall within a public road reserve must also comply.

The length of steep road sections shall be kept as short as possible. It is advisable to have a reasonably level section of road at most every 50 m.

The stability of abutting slopes, walls and fences must be ensured.

Utility services must be adequately protected. And access thereto ensured, in consultation with the relevant service authority or service owner.

9.4.2. Minimum Standards

Steepest longitudinal grade: 27%.
Minimum width as specified hereinbefore.
Approach to intersection: Maximum longitudinal grade 5% over a length of at least 10 m (5 m for a private driveway).
Maximum crossfall 5%.

9.4.3. Pavements for Steep Gradients

The pavement structure must be constructible on steep slopes.

The maximum gradient at which asphalt surfacing can be placed is 14%. All roadways with steeper gradients shall therefore have Block or Concrete pavements, with support beams at regular intervals of very steep slopes.

Surface roughness must be adequate in wet conditions over the full expected life of the road.

9.4.4. Pedestrian facilities on steep terrain
Where road width is less than 5 m, or where there is a risk involved in pedestrians using the roadway, a separate footway shall be provided.

Maximum longitudinal slope for a footway is 15%. For steeper sections steps must be provided, which must conform to the following:
- Minimum width of steps: 1.5 m.
- Maximum no of steps between landings: 12.
- Landings must be at least 1 m long.
- Maximum rise per step is 170 mm.
- Minimum step depth is 250 mm.
- Step rise and step depth shall be uniform for each section between landings.

10. Traffic Control Devices and Signage

10.1. General

For all forms of traffic control devices reference should be made to latest edition of the South Africa Development Community Road Traffic Signs Manual (SADC-RTSM) that replaced the previous South African Traffic Signs Manual (SARTSM) and SATCC manuals.

For detailed design and construction of traffic signals reference needs to be made to the specifications as laid down in the CMA Specification for Traffic Signals.

Traffic control devices shall comply in all respects with the requirements of the National Road Traffic Act 1996 (Act No. 93 of 1996) and the National Road Traffic Regulations 2000, promulgated in terms of the Act. It is therefore important that professionals with experience and knowledge of the subject undertake the design, installation and operation of traffic signals and signage.

10.2. Relevant codes of practice, policy and guidelines [add publishers, dates]

- SARTSM and SADC-RTSM Manuals
  - Volume 1: Uniform Traffic Control Devices (SADC-RTSM)
    - Detailing signing policies and design principles together with specific information on the meaning and application of all traffic control devices
  - Volume 2: Traffic Control Device Applications (SARTSM)
    - This volume covers the use of sets of signs, markings and signals for specific applications
  - Volume 3: Traffic Signal Design (SARTSM)
    - Detailing in depth, requirements for the selection and installation of traffic signals and their methods of control
  - Volume 4: Traffic Signs Design (SADC-RTSM)
    - Dimensional details for all road traffic signs and sign face components

- The CMA Specification for Traffic Signals

10.3. Traffic Signals Design

With each proposal for traffic signals the following is required:

- A scaled drawing (1 : 250) of the intersection or junction with the road layout, lanes and road markings.
- Ducting and draw box layout for underground cabling.
- The number, type and layout of signal faces and pole positions.
- The number, type and location of pedestrian and cyclist facilities, including the position of push buttons.
- The phasing, time plans and offset settings.
- The layout of loop detectors.
- The proposed date of implementation.

11. Stormwater

11.1. General

Designers shall base their design on a sustainable stormwater management system and all factors that will impact on the future operation and maintenance of the system needs to be considered. Maintenance requirements shall be kept to an absolute minimum.
For a more detailed approach to Stormwater Management reference needs to be made to the guidelines as set out below.

The Stormwater drainage design is to be based on the concept of Minor and Major systems as prescribed in the Red Book [use formal title].

11.2. **Relevant codes of practice, policy and guidelines**

- Guidelines for Human Settlement Planning and Design (Red Book).
- TRH 15 – Subsurface Drainage for Roads

11.3. **Stormwater Design**

11.3.1. **Design Principles**

The following elements must be incorporated in the Stormwater drainage design:

- The main Stormwater routes should be located along natural drainage routes.
- Major systems shall be free draining and local low points in roads will generally not be allowed.
- Runoff from properties must be adequately accommodated. This includes runoff from upstream properties, where applicable.
- During major storm events [this needs to be defined; 1:10 year?], the traffic function of residential and lower order roads is interrupted and the full Stormwater carrying capacity of the roads can be utilized. The flow may not encroach beyond the road reserve boundaries. The maximum allowable inundation above road crown during major storm events is 150mm. [This is not practical where a road has an excessive crown. Perhaps better to set a maximum above the drainage structure invert.]
- Where local low points are unavoidable provision shall be made for emergency overland escape routes. In these cases a double gully or larger shall be provided.
- Debris and pollutant removal facilities must be placed to protect downstream facilities and infrastructure.
- Appropriate measures must be put in place to minimise scour and erosion.
- Stormwater discharge must not be concentrated on any downstream property, except where such concentration of flow occurred previously, or if the flow is discharged via a servitude.
- The post development runoff should not exceed the pre development runoff.

11.3.2. **Minor System**

The minor system provides for the convenience of the community by rapidly removing runoff caused by storms of relatively short return period from the drainage area, mainly via an underground pipe network. The system also includes kerb inlets, catchpits, manholes, road-edge channels, and open channels.

The applicable minor system design storm return period varies according to land use. The different return periods are listed in the table below.

<table>
<thead>
<tr>
<th>Development</th>
<th>Design storm return period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>2</td>
</tr>
<tr>
<td>General commercial &amp; industrial</td>
<td>5</td>
</tr>
<tr>
<td>Public buildings</td>
<td>5</td>
</tr>
<tr>
<td>High value CBD</td>
<td>5 to 10</td>
</tr>
</tbody>
</table>
11.3.3. Major System

The Stormwater management system for all new townships must be designed to safely contain floods up to the 1:50 year flood without the flooding of properties. Conditions should also be checked for the 1:100 year event to ensure that floor levels will not be inundated.

The major system is the trunk system that receives Stormwater discharge from the minor system. It also functions as the emergency system that operates during overflow from, or failure of the minor system. The system includes watercourses, large conduits, roads, Stormwater attenuation facilities, drainage servitudes, flood plains, public open spaces, sports fields and parking areas.

The major system fulfills a flood control function only during major, infrequent storm events. During such events, temporary disruption of many normal activities within the catchment will occur, owing to the intensity and magnitude of the event. The loss of convenience is tolerable, if the disruption is restricted to the following:

- Residential and lower order roads
- Recreational areas and public open space
- Parking areas

The minor underground pipe system shall be assumed to be flowing full during a major storm event. The effect of blockages occurring in the minor system must be checked.

11.4. Storm Rainfall and Modelling Criteria

Stormwater design shall be based on the IDF (intensity-duration-frequency) figures obtained from rainfall monitoring stations most suitably located in relation to the nearby hills or mountains of the catchment area in question.

For the calculation of Stormwater runoff and storage capacities reference should be made to Stormwater Management Planning and Design Guidelines for New Developments which describes the recommended techniques and modeling tools in detail.

11.5. Physical Design Criteria

The physical criteria and requirements for the various Stormwater design elements are set out in the sections below.

11.5.1. Stormwater Pipes and Box Culverts

<table>
<thead>
<tr>
<th>Stormwater pipe design criteria</th>
<th>300 mm (nominal dia.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum diameter – catchpit connections</td>
<td>300 mm (nominal dia.)</td>
</tr>
<tr>
<td>Minimum diameter – longitudinal lines</td>
<td>375 mm (nominal dia.)</td>
</tr>
<tr>
<td>Pipe class: 300 – 525 mm dia.</td>
<td>100 D</td>
</tr>
<tr>
<td>600 mm dia.</td>
<td>75 D</td>
</tr>
<tr>
<td>750 mm dia.</td>
<td>50 D</td>
</tr>
<tr>
<td>Joint type</td>
<td>Spigot and socket (and rubber ring seal)</td>
</tr>
<tr>
<td>Bedding type</td>
<td>Class B (SABS 1200 LB)</td>
</tr>
<tr>
<td>Position in road reserve</td>
<td>High side of reserve. Refer to Section 3.4.1</td>
</tr>
<tr>
<td>Minimum slope: 300 mm dia.</td>
<td>1 : 80 (1.25 %)</td>
</tr>
<tr>
<td>375 mm dia.</td>
<td>1 : 250 (0.40 %)</td>
</tr>
<tr>
<td>≥ 450 mm dia.</td>
<td>Minimum velocity criteria</td>
</tr>
<tr>
<td>Minimum 80% full flow velocity</td>
<td>0.9 m/s</td>
</tr>
<tr>
<td>Maximum velocity</td>
<td>3.5 m/s</td>
</tr>
<tr>
<td>Minimum cover (road intersections)</td>
<td>1000 mm</td>
</tr>
<tr>
<td>Minimum cover (general)</td>
<td>750 mm</td>
</tr>
<tr>
<td>Maximum distance between manholes</td>
<td>90 m</td>
</tr>
</tbody>
</table>

- Where possible, road edge channels to be used in place of smaller pipes to reduce occurrence of blockages.
Stormwater pipes generally to be situated shallower than sewers.
Free flowing connections (i.e. 45° connections) should be promoted where possible and 90° connections avoided.
Box culverts to have dished inverts to cater for low flows.
Interlocking joint (ogee) pipes may only be used in public open spaces. Joints to be wrapped with a 400mm wide approved non-polyester geotextile with a 300mm overlap and secured with nylon straps on both sides.

11.5.2. Catchpits (also known as “gullies”)

- In developments where windblown sand is a problem the number of catchpits shall be kept to an absolute minimum. The maximum flow capacity of the road cross-section to be used to determine positions of catchpits.
- The percentage flow past a catchpit shall not exceed 20%.
- Maximum distance of overland flow in channels adjacent to roads to be 150 m.
- Catchpit to catchpit pipes are not acceptable.
- Catchpit connection lengths may not exceed 15m.
- Kerb inlet openings to be 100mm high.
- Skew kerb inlets to be used where the road gradient exceeds 8%.
- Catchpits generally to be located to prevent surface flows across roads and intersections.
- Inlet kerbs preferably to be of same profile and height as adjoining kerbs.
- Catchpits in surfaced roads to be side inlet kerb type with precast concrete cover slab with cover and frame to withstand the loading requirements of SABS for Heavy Duty applications.
- Grid inlet catchpits are generally not recommended as they are prone to blockages.
- Where the use of grid inlets is unavoidable, the grid inlets shall be manufactured from heavy duty mild steel flat bars and angle iron frame and attached by means of stainless steel (304) bullet hinges. The frame and grid shall be able to withstand the loading requirements of SABS 1882.
- Catchpits may not be positioned in kerblines with radius less than 20 m.
- In windblown sandy areas Catchpits shall be provided with a 75 mm sand trap (invert level 75 mm below invert of outgoing pipeline) instead of benching to assist with regular shovel cleaning operations.

11.5.3. Manholes

- Manholes must be provided at all horizontal and vertical changes in direction, at all pipe junctions and end points. No concealed junction boxes are allowed.
- All pipe connections shall be crown to crown.
- Manholes are to be standard brick manholes with precast concrete top slabs. Alternatively, precast ring type manholes (minimum 1050 mm diameter), may be used.
- Maximum chimney height to be 400mm.
- Manhole access shafts to be located to permit free access for bucket machine cleaning cables and equipment.
- Widening must be provided on outside curves of benching to accommodate bucket cleaning.
- All manhole covers and frames to be Heavy Duty ductile iron with hinged cover in compliance with EN124-D400.
- The hinge of the lid must be positioned on the side of the approaching traffic in the lane.
- Maximum distance between manholes to be 90 m.

11.5.4. Junction Boxes

Junction boxes are not acceptable and should generally be avoided.

11.5.5. Subsoil Drains

- Subsoil drainage is required to ensure that pavement and subgrade layers are well-drained to at least the material depth as defined in TRH 4, but to at least 800 mm below the road surface.
- Subsoil drainage systems shall be installed in all areas where a high water table can be expected in the wet season.
- Subsoil drains shall generally be installed along a road on the upstream side of the road reserve to form a cut-off drain, directly behind the kerb line.
- Sausage and fin type subsoil drains are not permitted.
- Subsoil drains shall have dual filter mediums that consist of a combination of granular and synthetic materials. The synthetic filter shall be placed on the sides and on top. The bottom of the subsoil drain shall not be covered with geotextile and shall form the granular filter.
• All subsoil drains shall be provided with piped systems that are connected by means of manholes. The pipe shall have a stone bedding and blanket with the perforations or holes at $60^\circ \pm 5^\circ$ on both sides of the pipe invert.

<table>
<thead>
<tr>
<th>Sub-soil drain design criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum internal manhole diameter</td>
<td>750 mm</td>
</tr>
<tr>
<td>Maximum manhole spacing</td>
<td>60 m</td>
</tr>
<tr>
<td>Drainage medium</td>
<td>9.5 mm</td>
</tr>
<tr>
<td>Synthetic filter</td>
<td>SABS 1083</td>
</tr>
<tr>
<td>Minimum drainage pipe diameter</td>
<td>100 mm</td>
</tr>
<tr>
<td>Pipe type (with smooth internal surface)</td>
<td>UPVC to SABS 1601, “Corflo” or similar with smooth internal bore with holes or slots</td>
</tr>
</tbody>
</table>

### 11.5.6. Open Stormwater Channels

Open Stormwater channels are generally not accepted within the City and especially in areas where windblown sand or other debris is a problem. Where unavoidable, the following will be the minimum standards:

<table>
<thead>
<tr>
<th>Open Stormwater channel design criteria</th>
<th>Unlined</th>
<th>Lined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum longitudinal slope</td>
<td>0.5 %</td>
<td>0.25 %</td>
</tr>
<tr>
<td>Maximum flow velocity</td>
<td>1.0 m/s*</td>
<td>2.5 m/s</td>
</tr>
<tr>
<td>Maximum side slopes</td>
<td>1:2 to 1:4, depending on material</td>
<td></td>
</tr>
</tbody>
</table>

• Unlined earth drain assumed. Max velocity can be increased in rock.

• Acceptable linings include: stone pitching; grouted stone pitching; concrete; Hyson Cells.

### 11.5.7. Streets

• Runoff form side streets must be controlled and if the street length exceeds 80 m, the runoff must be collected on the side street to avoid overrun on intersections.
• Kerb inlets (no grid inlets) to be used on surfaced roads.
• Grid inlets may be used in unsurfaced roads.
• Paved side drains required for unsurfaced roads when the gradient of the drain is greater than 3%.
• Energy dissipation is required when flow velocities exceed 3 m/s in roadside channels.
• Steeply sloping roads that terminate in a T-junction must be avoided.
• V-channels may not be constructed across adjoining roadways.
• Roadways with unpaved raised median islands shall be provided with effective subsoil drainage systems to prevent water from entering the adjacent pavement layers.

### 11.5.8. Detention Ponds

• The number of detention ponds must be kept to a minimum to reduce maintenance needs. Small detention ponds are to be avoided.
• Detention ponds shall generally be dry ponds.
• Wet ponds are only permissible where the water depth can be sustained at a minimum of 1.2 m [Is this reasonable? Could it be shallower?] throughout the dry season.
• Adequate warning signs or safety measures to be provided with wet ponds to protect the public.
• Subsoil drains to be installed to allow efficient drainage.
• Banks to be stabilised, grassed and irrigated.

<table>
<thead>
<tr>
<th>Detention pond design criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum bottom slope</td>
<td>1 : 200</td>
</tr>
<tr>
<td>Maximum embankment slope</td>
<td>1 : 4</td>
</tr>
<tr>
<td>Minimum backdrop at outlet structure to allow subsoil drainage (Invert level below pond bottom)</td>
<td>800mm</td>
</tr>
<tr>
<td>Minimum outlet diameter</td>
<td>200 mm</td>
</tr>
</tbody>
</table>
Refer to “Planning Guide Stormwater Ponds: Location and Design Considerations”, October 2003, D:R&S.

11.6. **Flood Escape Routes**

Trapped low points must be avoided. Where trapped low points are unavoidable the flood escape routes shall be accommodated through one of the following systems:

- Public open spaces provided along drainage routes.
- Registered servitudes over private properties. No structures or boundary walls may be erected within such servitudes. This option is however not recommended.
- Underground drainage to allow for the 1:50 year storm event.

12. **Sewers**

12.1. **General**

The sanitation system described in this section is that of a fully waterborne sewerage system with separate connections to individual erven.

The main sewer line will be constructed within road reserves. Midblock sewers are generally not permitted and will only be allowed where it is impossible to drain to the road reserve.

With any proposed development an overall sewerage management plan needs to be submitted that takes into consideration existing and future developments. Existing downstream systems also must be investigated to determine the potential for capacity for additional flows.

12.2. **Relevant codes of practice, policy and guidelines**

- Guidelines for Human Settlement Planning and Design (Red Book)

12.3. **Design**

12.3.1. **General**

<table>
<thead>
<tr>
<th>Sewer design criteria for residential use.</th>
<th>Lower</th>
<th>Middle</th>
<th>Higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litres per dwelling unit per day</td>
<td>500</td>
<td>750</td>
<td>1000</td>
</tr>
<tr>
<td>Based on average total persons per dwelling unit</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

**Allowance for stormwater infiltration**
- Minimum velocity: 0.70 m/s
- Peak factor: See Figure C.1, Chapter 10 of the Red Book

12.3.2. **Sewer Pipe Lines**

<table>
<thead>
<tr>
<th>Sewer pipe line design criteria</th>
<th>100 mm (nominal dia.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum diameter – house connections</td>
<td>150 mm (nominal dia.)</td>
</tr>
<tr>
<td>Minimum diameter – main lines</td>
<td>Class B (SABS 1200 LB)</td>
</tr>
<tr>
<td>Bedding type</td>
<td>Centre line or slightly offset on cambered roads. Refer to Section 3.4.2</td>
</tr>
<tr>
<td>Position in road reserve</td>
<td>0.9 m/s</td>
</tr>
<tr>
<td>Minimum full flow velocity</td>
<td></td>
</tr>
<tr>
<td>Maximum velocity</td>
<td>3.5 m/s</td>
</tr>
<tr>
<td>Minimum cover</td>
<td>1000 mm</td>
</tr>
<tr>
<td>Maximum distance between manholes</td>
<td>90 m</td>
</tr>
<tr>
<td>Minimum gradient for 160 mm pipes:</td>
<td></td>
</tr>
<tr>
<td>Number of dwelling units:</td>
<td></td>
</tr>
<tr>
<td>Less than 10</td>
<td>1 : 100</td>
</tr>
</tbody>
</table>
10 to 80 & 1 : 120 \\
81 to 110 & 1 : 150 \\
111 to 130 & 1 : 180 \\

| Minimum gradient for pipe sizes >160 mm: | \\
|---------------------------------------| \\
| 200                                  | 1 : 260 \\
| 225                                  | 1 : 300 \\
| 250                                  | 1 : 340 \\
| 300                                  | 1 : 440 \\
| 375                                  | 1 : 600 \\
| 450                                  | 1 : 760 \\
| 525                                  | 1 : 940 \\
| 600                                  | 1 : 1080 \\

12.3.3. Pipe Materials

<table>
<thead>
<tr>
<th>Diameter Range (mm)</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 34 heavy duty complying to SABS 966 using spigot and socket rubber ring joints or Fibre cement C.O.D. Class D bitumen dipped complying to SABS 1223 with Triplex Couplings</td>
<td></td>
</tr>
</tbody>
</table>

- All pipes, fittings and accessories shall comply with the latest edition of the relevant SABS specification.

12.3.4. House Connections

- Sewer house connections shall be 100 mm nominal diameter and shall extend 1 m into the erf boundary.
- The sewer house connection shall be terminated with an end cap, rodding eye or boundary chamber. In low income housing developments where the house is constructed within 2 m from the road reserve the house connection shall be extended so that the rodding eye is positioned against the house wall.
- Rodding eyes on erven must be covered with a standard Heavy Duty polymer concrete cover and frame as shown on Drawing S4.
- Shared connection for two properties will only be permitted in low income housing projects.
- House connection depth shall generally be 1,0 m, but should be designed to at least be able to drain 80% of an erf.
- House connections shall not be deeper than 1,2 m.
- Junctions and specials to be same wall thickness as the sewer main.
- Each house connection shall be linked to the main with a Y-junction or be connected at a manhole.
- The position of the house connection shall be marked on the kerb by cutting a slot 5 mm deep into the concrete surface with an angle grinder. The slot shall be painted with an approved paint.
- Marker posts to be installed at sewer house connection points to consist of 75 x 150 x 1000 mm concrete edging stones placed vertically, protruding 100 mm above finished ground level.

12.3.5. Manholes

- Manholes shall be provided at all horizontal and vertical changes in direction, at all pipe junctions and end points.
- All pipe connections excluding backdrop connections shall be crown to crown.
- Manholes are to be precast concrete ring type manholes (minimum 1050 mm diameter) with precast top slabs.
- Dolomite aggregate and low alkali sulphate resistant cement to SABS 471 shall be used for all concrete, mortar and screeding.
- All brickwork shall be plastered internally and externally
- All manholes shall be water tight.
- Connecting pipework shall be fitted with flexible joints.
• All covers and frames to be Heavy Duty ductile iron with hinged cover complying with EN124-D400.
• The hinge of the lid must be positioned on the side of the approaching traffic in the lane, or at right angles to the direction of flow.
• Maximum distance between manholes to be 90 m.

12.3.6. Rodding Eyes

Roddng eyes may be used at the head of a sewer run if distance to nearest manhole is less than 30 m.

The following requirements will be adhered to when installing rodding eyes:

• Long radius (radius more than \( ? \) mm) bends must be used at rodding eyes
• The rodding eye must be covered with a standard Heavy Duty manhole cover and frame as specified for sewer manholes.

13. Water Reticulation

13.1. General

Developers are required to provide water reticulation networks with capacity sufficient to for the type of development proposed. Any proposed system needs to integrate with existing and future surrounding developments.

The design shall be analysed on the City’s overall water reticulation network. The Water Services Department may require a hydraulic modelling analysis for a project in order to evaluate and properly develop the available water source. Improvements may need to be incorporated into the network to provided an overall well-balanced system.

Designers shall make every effort to loop water mains throughout a system and to eliminate dead end mains.

Transmission water mains are typically 250 mm in diameter and larger. Transmission mains shall have parallel distribution mains in order to supply water for service connections. House connections will not be allowed on transmission mains. Transmission mains shall not be located in narrow residential roads.

Bulk transmission mains, generally those with a diameter greater than 350 mm, are not covered in this section. Special approval for the pipe materials, specials, fittings and chambers need to be obtained from the Water Services Department.

13.2. Relevant codes of practice, policy and guidelines

• Guidelines for Human Settlement Planning and Design (Chapter 9).

13.3. Water Reticulation Design

13.3.1. Design Criteria

<table>
<thead>
<tr>
<th>Water Reticulation design criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum water demand for low cost housing</td>
</tr>
<tr>
<td>Water demand for other uses</td>
</tr>
<tr>
<td>Peak Factor</td>
</tr>
<tr>
<td>Hydrant Spacing for Fire Fighting (for all risk groups)</td>
</tr>
<tr>
<td>Fire Flows for High to Moderate Risk Groups (minimum hydrant flow rate)</td>
</tr>
<tr>
<td>Fire Flows for all Low Risk Groups (minimum hydrant flow rate)</td>
</tr>
<tr>
<td>Minimum/ Maximum Head</td>
</tr>
</tbody>
</table>

13.3.2. Water Pipe Lines

<table>
<thead>
<tr>
<th>Water pipe line design criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Group</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Minimum diameter – house connections serving one erf</td>
</tr>
<tr>
<td>Minimum diameter – house connections serving two erven</td>
</tr>
<tr>
<td>Minimum Pipe Size for distribution mains</td>
</tr>
<tr>
<td>Minimum gradient</td>
</tr>
<tr>
<td>Minimum cover for pipe sizes 25 to 50mm</td>
</tr>
<tr>
<td>Minimum cover for pipe sizes 75 to 100mm</td>
</tr>
<tr>
<td>Minimum cover for pipe sizes 150 to 200mm</td>
</tr>
<tr>
<td>Minimum cover for pipe sizes 250 to 350mm</td>
</tr>
<tr>
<td>Bedding type</td>
</tr>
<tr>
<td>Position in road reserve</td>
</tr>
</tbody>
</table>

13.3.3. Isolating Valves

- Isolating valves shall be provided such that no more than four valves need to be closed to isolate a section of main.
- Valves shall be spaced so that the total length of main included in an isolated section does not exceed 600 metres.
- Where pipes intersect, isolating valves shall generally be installed in the smaller diameter branches.
- Valves shall generally be located opposite erf boundary (splay) pegs. Avoid placing valves underneath kerb lines or driveways.

13.3.4. Fire Hydrants

Designers’ attention is drawn to the location of fire hydrants within a proposed reticulation system. Fire hydrants not only provide water for fire fighting but also assist in maintenance and repair issues such as drainage of the system and for air relief. The location of fire hydrants at low and high points in the system is therefore essential. Fire hydrants should also be located such that they will be easily accessible. Fire hydrants must not be further away than … m from a road edge.

The position of all fire hydrants must be clearly marked with the appropriate symbol painted onto the road surface at the nearest point on the road, or by painting a kerb (1 m) yellow at the closest point.

13.4. Water Reticulation Materials

13.4.1. Pipe Materials

<table>
<thead>
<tr>
<th>Water Reticulation Pipe Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter Range (mm)</td>
</tr>
<tr>
<td>20 to 40</td>
</tr>
<tr>
<td>75 to 300</td>
</tr>
<tr>
<td>100 to 300</td>
</tr>
<tr>
<td>&gt; 300</td>
</tr>
</tbody>
</table>

- All pipes, fittings and accessories shall be class 16, in compliance to the latest edition of the relevant SABS or ISO specifications and JASWIC approval.
- That all bends, tee’s reducers etc. to PVC pipes be Ductile Iron to EN 12842, fusion bonded thermoplastic coated internally and externally with Plascoat PPA 571 HES, to minimum 0.25 mm coating thickness.
13.4.2. Valves

Scour and air valves to be installed as required. Scour valves may not discharge into underground drainage systems, only into open surface drains.

- All valves shall be in accordance with SABS 1200 / SABS 664/1974, and be approved by the Technical Support Services Manager of the relevant Administration.
- Valves to be of the resilient seal or wedge-gate type. Resilient seal valves shall be used for general applications, and wedge-gate valves shall be used for valves dividing zones, or similar key applications.
- Valves shall be clockwise opening / left hand closing.
- Direction of opening to be clearly marked on valve body or spindle cap.
- Valves shall be heavy duty; class 16.
- Valves shall have non-rising spindles.
- Valves shall be fitted with cast iron cap tops, secured with retaining bolts.
- Cast iron gate type valves shall be Downright or similar approved.
- Only valves supplied with minimum thickness of 225 micron Copon EP 2300 epoxy paint applied to all internal surfaces after it has been thoroughly cleaned by grit blastings to SA 2 ½ finish in compliance with the requirements of SIS 05 09 00 or valves with similar approved coatings, will be acceptable.
- Valve chambers shall be constructed in accordance with Drawing W1.
- Valve bell tobies shall be polymer concrete conforming to SANS 1882 : 2003 (AV Mouldings or similar approved).
- Valve covers for general purpose valves shall be painted blue and shall protrude about 25mm above ground level in non paved areas.
- Valve covers for zonal valves and valves which generally remain closed, shall be painted red and shall protrude about 25mm above ground level.

13.4.3. Fire Hydrants

- Fire hydrants shall be the Ainsworth type and shall be installed in accordance with SABS 1200, comply with the local Fire Department standard regulations, and approved by the City's Nominated Project Engineer.
- All Fire Hydrants shall be 65 mm diameter (internal).
- Outlets shall be London round thread with loose cap and securing chain.
- Hydrant spindles shall be provided with cast iron caps, secured with retaining bolts.
- Hydrants shall be clockwise opening / left hand closing.
- Only hydrants supplied with minimum thickness of 225 micron Copon EP 2300 epoxy paint applied to all internal surfaces after it has been thoroughly cleaned by grit blastings to SA 2 ½ finish in compliance with the requirements of SIS 05 09 00 or hydrants with similar approved coatings, will be acceptable.
- Hydrant covers shall be polymer concrete conforming to SANS 1882: 2003 (AV Mouldings or similar approved) and shall be painted with a minimum of two coats yellow oil paint, or impregnated with yellow colouring during casting. The covers are to be secured to the frame with a galvanised chain or cable.
- Hydrants shall be supplied and installed complete with a flanged CI extension piece complete with cadmium-plated nuts and bolts to ensure depth not greater than 400 mm.
- Hydrant chambers to be constructed in accordance with Drawing W2.
- Hydrants shall be installed at the end of dead “runs” for charging and bleeding the lines.

13.4.4. Fittings and Specials

- Fittings and specials for uPVC pipes shall be cast iron or ductile iron with spigot and socket rubber ring joints and shall comply with the relevant requirements of SABS 966 or EN 12842.
- All cast iron or ductile iron fittings shall be fusion bonded thermoplastic coated internally and externally with Plascoat PPA 571 HES, to a minimum thickness of 250 micron.
- Only stainless steel bolts and nuts shall be used on all fittings such as saddles, flanges, short collar couplings, etc.

13.4.5. House Connections

- House connections shall be installed as indicated on Drawing W3.
• Saddles shall be ductile iron or cast iron, secured with stainless steel bolts and nuts, and wrapped in “Denso” tape or similar approved.

• Ferrules are not required.

• The position of the house connection shall be marked on the kerb by cutting a 5mm deep slot with an angle grinder into the concrete kerb face. The slot shall be painted blue.

13.4.6. Domestic Water Meters < 50mm in diameter

Should the Developer elect to supply the water meter boxes and meters, the following shall apply:

• The meter shall comply with the SABS Standards Specification No. 1529-1:1994 and must be approved in terms of Section 18 of the Trade Metrology Act No. 77 of 1973 and Regulation 80 of Part II of the Trade Metrology Regulations. All meters must be tested and sealed by an authorised official in an SABS 0259 accredited laboratory, situated within the borders of South Africa.

• The meter must be plastic bodied, semi-positive rotary piston volumetric type, accuracy performance to Class “C” Specification, (KSM-T) with the following features:
  o Meter body to be manufactured from specially blended polyacetal.
  o Meter must be approved by Trade Metrology for vertical and horizontal installation.
  o Each meter must be backed with a 3 year guarantee against faulty workmanship and/or materials. Spare parts for meter and box must be locally available for a period of at least 10 years.
  o Meter must be fitted with a pulse output facility (1 pulse/0.5 l)
  o Meter must be fitted with a non-return valve.
  o Meter must be fitted with a three-way brass ballcock with trickle flow facility and special dual purpose key for lid and valve.
  o Meter must be fitted with SABS approved DZR Brass couplings, supplying 20mm female threaded
  o Meter couplings shall be designed that they retract when loosened to allow fitting or removal of the meter without complete disassembly connection points through meter box.
  o All purchased meters must have zero readings.

• The meter box shall be fitted with a base plate, a plastic male thread on both ends and a hinged lid, with viewing slot and tamper-proof locking mechanism. All shall be moulded from modified poly-propylene (UV stabilised).

• For low cost housing developments the preferred position of the water meter box is mounted on the wall of the proposed houses, provided that the house is situated within two metres from the erf boundary. In all other cases the meter shall be installed as per standard detail W2.

• A brass stopcock shall be installed on the property side of the water meter box, secured to the meter box with a short 15mm copper connecting pipe.

• Samples together of the proposed materials and fittings shall be supplied to the Technical Support Services Manager of the relevant Administration for approval.

14. Ducts

14.1. General

Engineering drawings for proposed roadways shall make provision for ducts for the various services in order to prevent roadways from being dug up in future for the laying of cables etc.

At design stage the service providers shall be contacted and their needs for ducts for future cables or other services shall be obtained from them in writing.

14.2. Relevant codes of practice, policy, guidelines and specifications.

• SABS 1200
14.3. Design Criteria

<table>
<thead>
<tr>
<th>Ducting design criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct to extend beyond kerb line (minimum distance)</td>
<td>1.0 m</td>
</tr>
<tr>
<td>Depth below finished road surface (low voltage cables)</td>
<td>750 mm</td>
</tr>
<tr>
<td>Depth below finished road surface (high voltage cables)</td>
<td>900 mm</td>
</tr>
<tr>
<td>Minimum trench width</td>
<td>600 mm</td>
</tr>
<tr>
<td>Minimum side clearance (between trench wall and duct)</td>
<td>200 mm</td>
</tr>
<tr>
<td>Minimum horizontal clearance between adjacent ducts</td>
<td>150 mm</td>
</tr>
<tr>
<td>Minimum vertical clearance between ducts</td>
<td>100 mm</td>
</tr>
</tbody>
</table>

- Draw wires (2.5 mm ø galvanised) to be installed in all ducting, with a 2 m free length at each end.
- Duct ends shall be sealed at end with uPVC end caps.
- Ducting for Traffic Signals shall be provided with Cable Inspection Chamber at duct ends as per detailed drawing R8.

14.4. Ducting Pipe Materials

<table>
<thead>
<tr>
<th>Ducting Pipe Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Provider</td>
<td>Pipe Diameter (mm Ø)</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Telecommunication</td>
<td>110</td>
</tr>
<tr>
<td>Electrical: Low Voltage</td>
<td>110</td>
</tr>
<tr>
<td>Electrical: High Voltage</td>
<td>160</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>110</td>
</tr>
<tr>
<td>Irrigation (parks)</td>
<td>110</td>
</tr>
</tbody>
</table>

14.5. Duct Marking Details

The positions of ducts shall be clearly marked on kerb lines, directly above the centre of the duct at the crossing point with the kerb line. The letter markings shall be cut into the kerb face with an angle grinder. The lettering shall be 5 mm thick by 75 mm high and the recesses shall be painted with enamel paint. The markings and colour shall be as specified below:

<table>
<thead>
<tr>
<th>Duct Marking Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Provider</td>
<td>Letter Marking</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Telecommunication</td>
<td>T</td>
</tr>
<tr>
<td>Electrical</td>
<td>E</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>R</td>
</tr>
<tr>
<td>Irrigation (parks)</td>
<td>P</td>
</tr>
</tbody>
</table>

15. Development Control

15.1. General

Designers’ and Developers’ attention is drawn to the City’s requirement in terms of private developments.

These requirements shall apply in all cases where changes, alterations, new or additions to infrastructure and services that need to be taken over by the City at completion of the works.

This section gives only a brief summary of the requirements.
15.2. Relevant codes of practice, policy, guidelines and specifications.

- Guidelines for Human Settlement Planning and Design (Red Book)
- Standard Conditions for the Construction or Alteration of Transport, Roads and Stormwater Infrastructure by Private Developers.
- SABS 1200
- SARTSM and SADC-RTSM Manuals

15.3. Legal Requirements

The Developer is responsible for ensuring compliance with applicable legislation including City of Cape Town by-laws. Certain activities may be subject to permit approvals by national and provincial government departments.

15.4. Site Development Plan

A fully detailed Site Development Plan (conceptual design) to an acceptable scale must be submitted to the relevant Director [?] for approval prior to the submission of a detail design. This is to allow for the setting of further requirements, specifications and conditions relating to Transport, Roads, Stormwater, Sewer and Water infrastructure which must be considered in the detail design. Attention must be given to the existing, planned and potential development in the vicinity of the development.

15.5. Detailed Design

The detailed design must be in accordance with the Minimum Standards for Civil Engineering Services in Townships sections of this document.

The design must be carried out and certified by an Engineering Professional registered with the Engineering Council of South Africa in terms of the Engineering Professionals Act, 46 of 2000 with competence in the relevant field.

15.6. Construction, Supervision and Testing

- No construction work may commence before an approval of the detailed design (in writing) is obtained from the D:R&S.
- No work may commence without wayleaves from the various Departments for Stormwater, Sewer, Water, Electricity and Telecommunication services. The Developer’s contractor must acquaint himself with the exact position of all underground services before commencing any excavation work.
- The D:R&S must be informed in writing not less than 5 working days before construction is due to commence.
- The standard of workmanship and the materials used shall be in accordance with SABS 1200. The City may however specify amendments to SABS 1200.
- Adequate supervision by a Registered Professional Engineer must be provided for the full duration of the works. In this regard a proposal for site supervision must be submitted to the D:R&S for approval before construction work commences. The proposal shall include the name (or names where a team is required) of the individuals proposed, their CVs and the time that they will devote to site supervision on the project. Failure to adhere to the approved proposal may jeopardise clearance for separate registration of the properties. The Registered Engineer may have no direct financial interest in the development, other than payment of standard professional fees for the work performed.
- The necessary testing as prescribed in SABS 1200 shall be carried out and the results thereof shall be made available to the D:R&S.

15.7. Supply of Water for Construction Purposes

The Developer shall note that water for construction purposes shall be obtained via metered standpipes. The use of erf or house leadings for the supply of construction water shall not be permitted.

15.8. Maintenance Guarantee

The developer shall furnish Council with a bank guarantee equal to 5% of the value of the roads and infrastructure to be constructed. The guarantee shall be to the satisfaction of the D:R&S and valid for the 12 month maintenance period, which shall commence from the date of the certificate of completion.
16. Drawing Standards and As-Built Requirements

16.1. General

Designers’ and Developers’ attention is drawn to the City’s requirement in terms of drawing standards and as-built requirements.

16.2. Symbols, Line Styles and Colour

Drawings supplied by consultants for Civil Engineering Services shall have the same symbols, line types and colours set out on drawing G1.

16.3. Layers

Drawings shall be produced in the following layers:

<table>
<thead>
<tr>
<th>Drawing Layers</th>
<th>Includes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>Kerb lines, road edge lines, V-channels</td>
</tr>
<tr>
<td>Sidewalks</td>
<td>Edging stone lines</td>
</tr>
<tr>
<td>Stormwater</td>
<td>Manholes, catchpits, pipelines</td>
</tr>
<tr>
<td>Subsoil drainage</td>
<td>Manholes, pipelines</td>
</tr>
<tr>
<td>Sewer</td>
<td>Manholes, pipelines</td>
</tr>
<tr>
<td>Water</td>
<td>Valves, hydrants, pipelines</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Valves, sprinkles, pipelines</td>
</tr>
<tr>
<td>Electrical</td>
<td>Surface boxes, electrical poles, light poles,</td>
</tr>
<tr>
<td></td>
<td>cables, overhead lines</td>
</tr>
<tr>
<td>Telecommunication</td>
<td>Surface boxes, poles, manholes, cables,</td>
</tr>
<tr>
<td></td>
<td>overhead lines</td>
</tr>
<tr>
<td>Cadastral</td>
<td>All erf lines, road reserves, erf numbers.</td>
</tr>
</tbody>
</table>

16.4. Plan Layouts

Plan layouts shall include the following information:

- Survey information, contour layout of existing surfaces
- All existing service and cadastral information
- Manhole numbers, cover levels and invert levels of all branches
- Co-ordinate list of all members
- Pipe diameters, classes and slopes
- Finished road surface contours of all intersections
- Grid positions (y, x) at regular intervals
- Legend for Services
- North point
- Locality plan with sufficient information to uniquely identify the location.

16.5. Longitudinal Sections

Longitudinal sections shall be provided of all underground services and roads to be constructed and shall include the following information:

- Existing ground profile.
- Depth and position of existing services to be indicated.
- Manhole numbers.
- Pipe diameters, length and slope.
- Stake values and final centre line road levels at regular intervals and at vertical and horizontal curve details.

16.6. As-Built Information

As-built information supplied by consultants at the completion of a project shall include the following:
- **Three (3) sets** of as built services layout plans (to a scale not smaller than 1:500) including longitudinal sections printed on A0 or A1 paper size be provided.
- All drawings must be referenced in WGS84 coordinate system.
- An electronically produced ASCII file in LYXZ format supplied by an independent surveyor (post construction survey) of the centre points of all surface boxes (manholes, catchpits, valves, fire hydrants etc), and kerb face positions at beginning and end points of all curves and changes in direction be provided as part of As Built information. Drawings must be adapted where the difference between Design and As Built exceeds the tolerance of 50 mm in XY position and 10 mm in Z (height).
- An ASCII or ACCESS (dbf file) in LYXZ format of the cover and invert levels of sewer and stormwater manholes, catchpits, hydrants and valves. The project name, company name and contact details must appear on the data set.
- As-Built drawings: electronic Allycad.drg format is preferred, or alternatively AutoCad.dxf (version 2000 or older). Grid positions to be indicated on all drawings. Is this really the preferred format?
- All attribute data, i.e. pipe sizes, materials, slopes, cover, lengths and invert levels, clearly indicated on the layout drawings, positioned at the entity.
- Drawings produced in different layers for each service.

17. Standard Detail Drawings

17.1. List of Standard Drawings

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>Date of Drawing</th>
<th>DRAWINGS NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROADS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kerb, Channel and Edging Details</td>
<td></td>
<td>R1</td>
</tr>
<tr>
<td>Typical Cross Section, 18 m Road Reserve of Mixed Middle-Order Link (Class 4, Local Distributor)</td>
<td></td>
<td>R2</td>
</tr>
<tr>
<td>Typical Cross Section, 12 m Road Reserve of Mixed Lower-Order Link (Class 5, Access Street) – 12 m Road Reserve</td>
<td></td>
<td>R3</td>
</tr>
<tr>
<td>Typical Cross Section, 10 m Road Reserve of Mixed Lower-Order Link (Class 5, Access Street) – 10 m Road Reserve</td>
<td></td>
<td>R4</td>
</tr>
<tr>
<td>Typical Cross Section, 8 m Road Reserve of Mixed Lower-Order Link (Class 5, Access Street) – 8 m Road Reserve</td>
<td></td>
<td>R5</td>
</tr>
<tr>
<td>Typical Cross Section, 6m Road Reserve of Pedestrian Only Link</td>
<td></td>
<td>R6</td>
</tr>
<tr>
<td>Detail of Widening of Curves on 8 m Road Reserves</td>
<td></td>
<td>R7</td>
</tr>
<tr>
<td>Electrical Duct Installation</td>
<td></td>
<td>R8</td>
</tr>
<tr>
<td>Cable Inspection Chamber</td>
<td></td>
<td>R9</td>
</tr>
<tr>
<td>Typical Speed Hump</td>
<td></td>
<td>R10</td>
</tr>
<tr>
<td>Typical Raised Pedestrian Crossing</td>
<td></td>
<td>R11</td>
</tr>
<tr>
<td>Typical Urban Compact Roundabout at Middle &amp; Lower Order Link Roads</td>
<td></td>
<td>R12</td>
</tr>
<tr>
<td>Section of Typical Urban Compact Roundabout</td>
<td></td>
<td>R13</td>
</tr>
<tr>
<td>Typical Mini Roundabout at Middle &amp; Lower Order Link Roads</td>
<td></td>
<td>R14</td>
</tr>
<tr>
<td>Section of Typical Mini Roundabout</td>
<td></td>
<td>R15</td>
</tr>
<tr>
<td>Typical Pedestrian Crossing for Disabled Persons</td>
<td></td>
<td>R16</td>
</tr>
<tr>
<td>Typical Taxi and Bus Embayment</td>
<td></td>
<td>R17</td>
</tr>
<tr>
<td>Road Name Kerb Details</td>
<td></td>
<td>R18</td>
</tr>
<tr>
<td>Precast Concrete Bollard</td>
<td></td>
<td>R19</td>
</tr>
<tr>
<td>Survey Mark</td>
<td></td>
<td>R20</td>
</tr>
<tr>
<td><strong>STORMWATER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsoil Drain</td>
<td>SW1</td>
<td></td>
</tr>
<tr>
<td>Manhole for Subsoil Drainage</td>
<td>SW2</td>
<td></td>
</tr>
<tr>
<td>Stormwater Manholes for Pipes up to 600 mm diameter</td>
<td>SW3</td>
<td></td>
</tr>
<tr>
<td>Stormwater Manhole for Pipes 675 mm diameter and larger</td>
<td>SW4</td>
<td></td>
</tr>
<tr>
<td>Stormwater Catchpit</td>
<td>SW5</td>
<td></td>
</tr>
<tr>
<td>Grid Inlet Catchpit</td>
<td>SW6</td>
<td></td>
</tr>
<tr>
<td>Stormwater Headwall</td>
<td>SW7</td>
<td></td>
</tr>
<tr>
<td><strong>SEWERAGE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewer Manhole</td>
<td>S1</td>
<td></td>
</tr>
<tr>
<td>Rodding Eye for short(max. 30m) Dead end Lines</td>
<td>S2</td>
<td></td>
</tr>
<tr>
<td>Oil/Petrol Intercepting Trap</td>
<td>S3</td>
<td></td>
</tr>
<tr>
<td>Sewer Erf Connection Layout</td>
<td>S4</td>
<td></td>
</tr>
<tr>
<td>Typical Sewer Connection Details</td>
<td>S5</td>
<td></td>
</tr>
<tr>
<td>WATER Chamber</td>
<td>Valve Chamber</td>
<td>W1</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------</td>
<td>----</td>
</tr>
<tr>
<td>Hydrant Chamber</td>
<td>Hydrant Chamber</td>
<td>W2</td>
</tr>
<tr>
<td>Typical Water Connection</td>
<td>Typical Water Connection</td>
<td>W3</td>
</tr>
<tr>
<td>Typical Water Meter Chamber</td>
<td>Typical Water Meter Chamber</td>
<td>W4</td>
</tr>
</tbody>
</table>

### COMMENT ON PLANS

**R1**
On all kerb and channel cross sections the level of the abutting road or footway surface must be shown. Plan is not complete – more types available as shown on “R1 Version 2”

**R4**
References to “TELKOM” should be replaced with “Telecommunication cables”.

**R7**
The road centreline radius should be 10.25 m, not 10 m.

**R13**
Detail 1 is incorrect; the road surface should be just below the (rounded) kink in the kerb. Detail 2: “MK11” should read “MK10”.

**R18**
The usual position of a street name kerb is within a kerbline. Freestanding name kerbs are not preferred, and should only be used in exceptional circumstances. Plan should be changed to show name kerbs in kerbline at the tangent points. Even where mountable kerbs are used, the corners should still have barrier kerbs. In this case the position is mountable kerb, 1m transition, street name kerb, barrier kerbs around corner, name kerb, transition, mountable kerb. Plan R18A shows an alternative design for a street name kerb.

**New R18B**
Plan showing pole mounted street name plate.

**R20**
Spelling of “galvanised”.

**R20**
A heavier chain (4 mm) is better.

**SW1**
After “8 mm holes at 75 mm centres”, add “positioned 60° ± 5° either side of the pipe invert”

**SW3**
Type of manhole cover and frame needs to be agreed!

**SW8**
Spelling of “gully”

**New**
Plan showing driveway crossing details

**New**
Plan showing ramped driveway access