STELLENBOSCH MUNICIPALITY

Design Guidelines and Minimum Standards for Civil Engineering Services

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NOTE: THESE DESIGN GUIDELINES AND MINIMUM STANDARDS ARE TO BE READ IN CONJUNCTION WITH THE DRAWINGS IN SECTION G: STANDARD DETAILS

SECTION A

PROCEDURES FOR THE PROVISION OF CIVIL ENGINEERING SERVICES FOR NEW DEVELOPMENTS

INDEX

A1 INTRODUCTION

This section serves as guideline for Developers regarding the procedures that should be followed for the provision of engineering services for new developments. Furthermore, it provides the time frame within which the different procedures should be completed in order to enable the Developer to make provision for this in his programme.

The onus to carry out the procedures, rests with the Developer and no deviations from it will be allowed, except in the case of written approval from the Director: Engineering Services.

The term "Developer" is used throughout the document, and it will be esteemed to include the consulting engineer or contractor appointed by him.

Where the term "Municipality" is used, it will refer to the Stellenbosch Municipality.

A2 THE LAND-USE APPLICATION PROCESS

Most properties will normally undergo a land-use application in terms of relevant land-use legislation that will entail land-use changes such as rezonings, subdivisions and consolidation of erven.

A land-use application will be submitted by the professional team of the developer who wishes to develop a property and the comprehensive application will normally also include an engineering report and a Traffic Impact Assessment or Traffic Impact Study.

A land-use application will be submitted to the Directorate: Planning who will ensure that the application is complete before the Directorate: Planning will circulate such an application to the relevant Directorates for their recommendation for approval or non-approval.

Such an application will be circulated by the Directorate: Planning to the Manager: Development Services who will comment on such an application on behalf of the Directorate: Engineering Services.

The Manager: Development Services will liaise with the technical departments, such as Water Services, Transport Roads and Stormwater and Solid Waste for their input before commenting on the application and will also calculate the development contributions payable in respect of the civil engineering services as per the Municipality's approved Development Contribution Policy.

It must be noted that a separate application document will be circulated by the Directorate Planning to the Electricity Department for their input and comment. The Electricity Department comment on an application and calculate electrical contributions independently form the civil engineering related service

departments within the Directorate.

Once the Manager: Development Services compiled his/her comment on the land-use approval, he/she will circulate such a formal approval to the Directorate: Planning for inclusion in the recommendation for approval or not.

In the case of a recommendation for a land-use approval by the Manager: Development Services, such a recommendation will contain numerous land-use approval conditions which is extremely important for the Developer's engineer to take cognisance of. (See the attached **ANNEXURE A1** for typical conditions that is subject to change on an ad-hoc basis.)

These conditions will include conditions reflecting standards of services, guidelines for the provision of services, development contributions, bulk infrastructure needed, level of services, maintenance responsibilities, plan approval conditions and many more.

The onus is on the Developer's engineer to ensure that he/she does have access to these conditions before commencing with further design of engineering services.

It must be noted that

a.) that no construction of any civil engineering services may commence before approval of internal - and external civil engineering services drawings;

b.) that no approval of internal - and external civil engineering services drawings will be given before land-use and or SDP approval is obtained;

c.) that no approval of internal - and external civil engineering services drawings will be given before the "Developer" obtains the written approval of all affected owners where the route of a proposed service crosses the property of a third party;

d.) that no building plans will be recommended for approval by the Directorate: Engineering Services before land-use and or Site Development Plan (SDP) approval is obtained;

e.) that no building plans will be recommended for approval by the Directorate: Engineering Services before the approval of internal - and external civil engineering services drawings;

f.) that no building plans will be recommended for approval by the Directorate: Engineering Services before a Clearance Certificate in terms of Section 31 of the Land-use Planning Ordinance is issued.

A3 ENGINEERING REPORT

As mentioned in the above Section, the Developer has to submit a report by a professionally registered (with ECSA) engineer in support of his application for rezoning and/or subdivision/consolidation and/or design approval, where the most important aspects for the provision of municipal services for the new development are addressed. This report should be accompanied by a set of drawings with sufficient detail in order for the Director: Engineering Services to assess the application in terms of the requirements of this document. The following information is specifically required:

a)	Background:	·	Location of premises
		·	Topography
		·	Soil conditions
		·	Existing structures on premises
		·	Existing services on premises
		·	1:20, 1:50 and 1:100 Year flood line (when applicable)
b)	Water provision:	·	Average and peak daily water demand
		·	Provisional design of internal distribution network
		·	Connection to existing external system
		·	Capacity of existing external system (as confirmed by the Municipality's master planning consultants)
		·	Provision for connection of future systems
c)	Sewerage:	·	Average and peak daily sewage flow
		·	Provisional design of internal network
		·	Connection to existing external system
		·	Capacity of existing external system (as confirmed by the Municipality's master planning consultants)
		·	Provision for connection of future systems
d)	Storm-water	:	Provisional lay-out of internal network
		·	Routes for overland run off during major storms
		·	Capacity of existing external system
		·	Provision for connection of future systems
		·	Relationship of pre-and post-development run-off and mitigation measures (where applicable)
e)	Roads:	·	Provisional lay-out of roads
		·	Classification of roads in order of preference
		·	Connection to existing road networks
f)	General :	·	Location of servitudes (when applicable)

A4 DEVELOPMENT AGREEMENT OR SERVICES AGREEMENT

These two types of documentation are often confused and we will endeavour to clear this matter.

A Development Agreement is a document that concludes an agreement between Stellenbosch Municipality and a Developer, confirming conditions such as standards of services, guidelines for the provision of services, development contributions, bulk infrastructure needed, level of services, maintenance responsibilities, plan approval conditions and many more. The need for such an agreement was mostly stipulated as a land-use condition for land-use approvals pre-2012.
Since 2012, the conditions normally stipulated in such a Development Agreement are now included in the land-use approval and the onus is on the Developer to object to any such condition in terms of the land-use legislation.

In order to honour the pre-2012 land-use approval conditions which might stipulate that a Development Agreement must be entered into, the Manager: Development Services, will compile such an Agreement, based on the Standard Template, attached herewith as **ANNEXURE A2.**

A Services Agreement, is a document that concludes an agreement between Stellenbosch Municipality and a Developer, confirming conditions to be adhered to in the case of bulk municipal services to be installed by a developer in-lieu of available development contributions normally payable by the Developer.

In such cases, the Manager: Development Services, will provide the standard Services Agreement, based on the Standard Template, attached herewith as **ANNEXURE A3**, to the Developer or his/her consulting engineer.
The onus is on the Developer and or his/her consulting engineer to ensure that the documentation required in terms of the annexures to the Services Agreement is provided to the Municipality together with an initialled and signed Services Agreement by the Developer and his/her witnesses.

A Services Agreement will only be concluded after land-use approval and after further negotiations with the Municipality.

A5 MUNICIPAL RATES CLEARANCE

In order for a Developer to transfer a newly developed property, he/she will have to obtain a rate clearance from the Municipality. In order for the Municipality to issue a Rate Clearance, the Developer will need a Clearance Certificate in terms of Section 31 of the Land-use Planning Ordinance of 1985.

The conditions for issuing a Section 31 Clearance certificate is highlighted in Annexure A1 and A2, but will be confirmed in the formal land-use approval.

In short, and relevant to the consulting engineer, an application for a Section 31 Certificate by the developer, will only be granted by the Director: Engineering Services after conforming to inter-alia the following conditions:

1. The **completion of installation of the engineering services** by the Developer, certification by the Developer's consulting engineer that the services were installed according to the approved plans and specifications, and the inspection and approval of the completed services by the different sections of the Engineering Departments; everything to the satisfaction of the Director: Engineering Services. The relevant documentation required to satisfy this condition are:

   a.) "Certificate of Practical Completion", as prescribed by the General Conditions of Contract for Construction Works – 2010)

   b.) As built drawings; GIS data and Asset Verification Data in hardcopy and electronic drawings must be approved (as complying with all the requirements) by the Director: Engineering Services, otherwise they are not regarded as valid. Refer to Section A11 for the as-built, GIS data and Asset verification Data requirements.

2. The conclusion of the physical and/or the financial arrangements regarding the connection services to the satisfaction of the Director: Engineering Services mentioned above.

3. The payment of development contributions (DC's) for the use of the Municipality's bulk services to the satisfaction of the Director: Engineering Services mentioned above or the conclusion of a Services Agreement in respect of bulk infrastructure to be provided in-lieu of development contributions and the provision of such services or as otherwise agreed with Manager: Development Services.

A6 APPROVAL OF DESIGNED SERVICES

The Developer must submit **three** sets of the detail design drawings and specifications for the designed services to the Director: Engineering Services which have to be approved before any construction work will be allowed to start. Such drawings MUST be scrutinised and signed by a professional engineer, registered with ECSA, before being submitted to the Municipality. No drawings will be accepted by the Municipality if not signed by such an Engineer.

The services must be designed according to acknowledged engineering principals and in accordance with the guidelines as found in the "Red Book *(Guidelines for human settlement planning and design)*", as well as in Sections B, C, D and E of this report. The onus rests with the Developer to bring any deviations from these design guidelines to the attention of the Director: Engineering Services well in advance, in order to ensure

that the designed services are approved. Any deviations should be properly motivated and approved in writing by the Director: Engineering Services.

It must be noted that ALL services, even internal on-site services, only serving a specific development and to be maintained by the Home Owners' Association or Body corporate, must be designed in accordance to the relevant design guidelines as contained in this Guideline and also be inspected by this Directorate.

A7 CONSTRUCTION OF SERVICES AND TESTING

The Developer or his consulting engineer must inform the Manager: Development Services when construction of services is about to start, as well as the dates of site meetings. A representative of the department will attend site meetings from time to time.
Agendas and Minutes of such meetings must be provided to the municipal engineer who will file such documentation on the relevant erf file at the Directorate: Planning Registry.

The Director: Engineering Services requires that the following tests according to SABS 1200 and/or the project specifications. Test 1, 2 and 3 shall be carried out on the newly completed engineering services in the presence of technical officials from his/her department or as otherwise agreed with the Developer's engineer:

1. Pressure tests for water pipes.

2. Pressure tests for sewers.

3. Mirror tests for sewers or video recordings as required by the Director: Engineering Services

4. Road layerworks materials classification tests.

5. Density tests confirming compaction of road layers and fills are according to specifications (also see Section E)

6. Any other tests required in terms of SABS 1200 and the project specifications.

7. The Engineer shall provide test certificates approved and signed for all relevant tests required.

8. Test certificates for items 1 to 3 above must be approved and signed by the Engineer and presented to the Manager: Water Services for acceptance prior to commencement of the final layer (i.e. blacktop or pavers) of the road.

The onus rests with the Developer to request the presence of the officials well in advance.

In the same way, the connection of new water systems (distribution networks and erf

connections) to existing main water pipes are carried out exclusively by the Water Services Department of the Municipality. The developer has to arrange this in due time and pay any deposits where necessary.

A8 COMPLETION INSPECTIONS FOR ISSUING: "CERTIFICATE OF PRACTICAL COMPLETION" AND "CERTIFICATE OF COMPLETION"

A8.1 CERTIFICATE OF PRACTICAL COMPLETION (GCC 2010 CLAUSE 5.14.1)

When the project is at a stage where the Contractor requests a Certificate of Practical Completion, the Developer shall obtain input (regarding work to be completed to justify Practical Completion) from the Engineering Services Department prior to issuing such certificate. In this regard, an inspection must be held in order for the Engineering Services Department to give such input. The following is required by the Municipality prior to inspection:

1. a site -inspection by the Developer's consulting engineer at least three days before the "practical completion site visit" by municipal engineers to ensure that the site is ready for inspection;

2. a single layout drawing highlighting the infrastructure included in the certificate. This layout must be attached to the final Practical Completion Certificate;

3. Test certificates in terms of Section A7 above - approved and signed by the Engineer;

4. As built drawings; GIS data and Asset Verification Data in hardcopy and electronic versions, complying with all the requirements of Section A11. These drawings must be approved (as complying with all the requirements) by the Director: Engineering Services, otherwise they are not regarded as valid. The Municipality, at their discretion, can elect to sign the Certificate of Practical Completion prior to as built being finalized, however, no rates clearance shall be issued and/or no payment of outstanding professional fees shall be made if approved as built drawings are still outstanding.

The Practical Completion Certificate should contain sections for signatures of the following Departments to indicate they have inspected and approved the Works and had input in the "snag list":

- Water Services Department (Water and Sanitation)
- Transport, Roads and Stormwater Department
- Development Services and Project Management Department

A8.2 CERTIFICATE OF COMPLETION (GCC 2010 CLAUSE 5.14.4)

After the "snags" recorded in the Certificate of Practical Completion have been duly completed the Developer has to officially inform the Manager: Development Services and request a Completion Inspection of the services, before the Engineer issues the Certificate of Completion.

As soon as the different departments have inspected the services and have given their signed approval, the Completion Certificate can be issued. As with the Practical Completion Certificate, the Completion Certificate should have attached a single layout drawing highlighting the infrastructure included in the certificate.

The Completion Certificates should contain signatures of the following Departments to indicate they have inspected the Works and are satisfied with its completion;

- Water Services Department (Water and Sanitation)
- Transport, Roads and Stormwater Department
- Development Services Department

This fully signed certificate will confirm that the services are now regarded complete and that (in the case of public services) it is taken over by the Municipality. With the issue of the Certificate of Completion, (and in the case of the newly constructed services being public services) the responsibility for the maintenance of services and the cost because of damage are carried over to the Municipality, with the exception of latent defects that may be discovered. In the case of a phased development, where structures (i.e. low cost housing) are to be constructed at a stage after the completion of the civil services, the Municipality will only take over the operation and maintenance of the services after the structures are completed. This is to ensure that the Developer takes responsibility for damages caused to the new services by construction vehicles etc.

A9 DEFECTS LIABILITY PERIOD

At the Municipality's taking over of completed services (Certificate of Completion), a 12 month period commences during which the Developer will still be responsible for repair work to latent defects in the construction, e.g. In the case of faulty workmanship.

A10 FINAL APPROVAL

After the expiry of the defects liability period of 12 months, the Developer has to request a final inspection from the department in order to obtain final approval of the services. Hereby the obligation and liability of the Developer regarding the development comes to an end, except for latent defects up to a period of 10 years in terms of Clause 5.16.3 of the General conditions of contract for construction works (GCC) 2nd Edition 2010.

A11 AS BUILT, GIS DATA AND ASSET VERIFICATION DATA

Notwithstanding the requirements of this section, the Developer's consulting engineer shall be responsible for the accuracy of "AS BUILT" information with regard to sewer and water connections. Where connections cannot be found in the locations as shown or described on the "AS BUILT" drawings, the additional cost to locate these services shall be for the account of the Developer.

A11.1 AS BUILT DRAWING REQUIREMENTS

- 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. A1 paper size is preferred. The following are required for the Municipality's record purposes:
  - **One (1)** set of plans printed on paper, loosely rolled up.

- All drawings to be geo referenced in WGS84 coordinate system.

- Electronically produced ASCII file in LYXZ and invert level format be supplied by a qualified surveyor employed by the design consultant (other than the contractors 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. As Built drawings must be altered and levels changed where the difference between Design and As Built exceeds the tolerance of 50 mm in XY position and 10 mm in Z (height).

- As Built drawings in electronic format AutoCad.dxf and AutoCad.dwg (version 2000 or older). A **PDF** version of all drawings is also required.

- All attribute data, i.e. pipe sizes, materials, slopes, lengths, cover-, and invert levels, flow direction arrows on pipes and dimensions of services in relation to cadastral boundaries must be clearly indicated on the layout drawings, positioned at the entity.

- Typical cross sections for the different Road Reserve widths, indicating the dimensioned positions of all services within the reserve.

- Drawings to be produced in different layers for each service to be provided.

- Services to be separated on the drawings as follows:
  - Water Layout
  - Sewer Layout
  - Roads and Stormwater Layout
  - Roadmarkings and Traffic Signage Layout

- The following information needs to be clearly indicated on the drawings:

  - Name of Development / Project
  - Grid positions with X and Y values at 100m c/c
  - North sign

- Street names
- Erf numbers
- Servitudes and their widths
- Dimensions of house connection positions in relation to cadastral boundary (typical detail on layout drawing)
- Actual positions of house connections on each erf
- Dimensions of midblock services in relation to cadastral boundary
- Clear indication whether the development has **PRIVATE or PUBLIC** owned services
- Bulk Water Meter details for private developments (Type, Make, Serial No., Reading, Account Holder details.)

- The complete electronic data set must be provided in CD format with the **name of the development / project , the mother erf number and the consultants company name and contact details** clearly indicated on both the cover and the CD disk.

A11.2 Geographic Information System (GIS) data capturing standards

In drawing up the As-built Plans relating to the development, the consultant must create the following separate layers in ESRI .shp, electronic file format in order for the data to reflect spatially correct.

Layer name	Content
TITLE	Title information, including any endorsements and
NOTES	All noted information, both from the owner / surveyor and
PARENT_PROPLINES	Parent property lines
PARENT_PROPNUM	Parent erf number (or portion number)
PROPLINES	New portion boundaries
PROPANNO	New erf numbers
SERVLINES	Servitude polygons
SERVANNO	Servitude type
STREET_NAMES	Road centre lines with street names
STREET_NUMBERS	Points with street numbers
COMPLEX BOUNDARIES	Where applicable, polygon with complex name (mention whether gated or not and if so, where gates are)
SUBURB	Polygon with suburb name, where new suburb / township extension created
ESTATE	Where applicable, polygon with estate name (mention whether gated or not and if so, where gates are)

When data is provided in a shp format it is mandatory that the .shx, .dbf, files should accompany the shapefile. The prj file containing the projection information must also accompany the shapefile.

It is important that different geographical elements for the GIS capture process remains separate. That means that political boundaries like wards or suburbs be kept separate from something like rivers. The same applies for engineering data types like water lines, sewer lines, electricity etc. that it is kept separate from one another. When new properties are added as part

of a development, a list of erf numbers with its associated SG numbers must be provided in an electronic format like .txt, .xls or .csv format.

For road layer shapefiles; the road name, the from_street and to_street where applicable as well as the start en end street numbers needs to be included as part of the attributes. A rotation field needs to be added to give the street name the correct angle on the map.

In addition to being geo-referenced and in WGS 1984 Geographic Coordinate System, the drawing must be completed using real world coordinates based on the Stellenbosch Municipality standard as follows:

- Datum : Hartebeeshoek WGS 84
- Projection : Transverse Mercator
- Central Longitude/Meridian 19
- False easting : 0.00000000
- False northing : 0.00000000
- Central meridian : 19.00000000
- Scale factor : 1.00000000
- Origin latitude : 0.00000000
- Linear unit : Meter

A11.3 ASSET VERIFICATION DATA

An electronic version of the latest Asset Verification Form can be obtained from Engineering Services: Development Services department. This document must accompany the as-builts and GIS data.

SECTION B

DESIGN GUIDELINES AND MINIMUM STANDARDS FOR WATER RETICULATION

INDEX

B1 PLANNING ASPECTS

B1.1 MASTER PLANNING

The planning of the internal water reticulation for a new development shall be in agreement with the master planning for water reticulation for the entire area. In this regard, it is expected of the developer's consulting engineer to determine the average daily water demand from the new development and to submit it in the Engineering report.

The Municipality's specialist consulting engineers will, should the Director: Engineering Services consider it necessary (on the cost of the Developer), investigate the effect of the proposed on the existing and make a recommendation regarding upgrading any existing infrastructure where necessary.

B1.2 LOCATION OF SERVICES IN ROAD RESERVE

The following drawings show the typical layout of services for different road reserve widths and should be used as a guideline:

SG2	Typical layout of services in 20m road reserves
SG3	Typical layout of services in 16m road reserves
SG4	Typical layout of services in 13m road reserves
SG5	Typical layout of services in 10m road reserves

B2 DESIGN STANDARDS

B2.1 AVERAGE DAILY DEMAND

Type of development		Average daily demand
Residential	*Zone I*	Refer Figure 8.26 in "Red Book"
	One house plus outside building	
	per erf (FSR < 0,5)	
	Erven $\leq$ 600 m²	600 - 1 200 l/erf/day
	Erven = 700 m²	700 - 1 350 l/erf/day
	Erven = 800 m²	800 - 1 500 l/erf/day
	Erven = 1 000 m²	1 000 - 1 850 l/erf/day
	Erven = 1 200 m²	1 250 - 2 200 l/erf/day
	Erven = 1 500 m²	1 550 - 2 700 l/erf/day

	Erven = 2 000 m²	2 100 - 3 450 l/erf/day
Residential (continue)		
	Zones II and III	600 - 1 000 l/dwelling unit/day
	Multiple dwelling units per	
	site, up to 3 storeys high	
	(FSR = 0,5 - 1,0)	
	Zone IV	450 - 700 l/dwelling unit/day
	Multiple dwelling units per	
	site; 4 storeys and higher	
	(FSR > 1,0)	
Business areas		10 kl/ha/day
Offices	FSR = 0,2	8 kl/ha/day
	FSR = 0,3	10 kl/ha/day
	FSR = 0,4	12 kl/ha/day
Government		400 l/100 m² gross floor area/day
Industries	Light	12,5 kl/ha/day
	General	25 kl/ha/day
	Water intensive ("wet")	Special investigation necessary
Day hospitals, Hotels		
	FSR = 0,2	12 kl/ha/day
	FSR = 0,3	17,5 kl/ha/day
Schools	Day schools < 2 ha	15 kl/ha/day
	> 2 ha <10 ha	12,5 kl/ha/day
	> 10 ha	10 kl/ha/day
	Boarding schools	As per day schools
		+ 150 l/boarder/day
Churches		2 000 l/day
Places of entertainment	FSR = 0,2	16 kl/ha/day
	FSR = 0,3	25 kl/ha/day
Developed parks	> 2 ha	15 kl/ha/day
	> 2 ha < 10 ha	12,5 kl/ha/day
	> 10 ha	10 kl/ha/day
Public Open Spaces		Site specific

ha = refers to hectare of erf area

FSR = Floor space ratio = (Total floor area) ÷ (Total erf area)

Note: Where upper and lower limits are provided, the upper limit applies to higher income areas, while the lower limit applies to lower income areas.

"Lower income areas" do not include informal settlements. For upgrading of informal settlements and similar types of projects, the lower limit shall be 900 l/erf/day.

B2.2 EQUIVALENT ERVEN (ee)

To simplify comparison and to enable the application of a peak factor, all average daily water demand for different types of developments need to be transformed to a common unit i.e. an equivalent erf (ee).

1 ee = average daily demand of 1 000 litre

B2.3 PEAK FACTOR

The peak factor for water demand is inversely related to the number of ee and shall be determined from Figure 9.11 of "*Guidelines for Human Settlement Planning and Design*".

B2.4 INSTANTANEOUS PEAK DEMAND

Instantaneous peak demand = average daily demand X peak factor.

B2.5 FIRE FLOW

B2.5.1 General

The provision of water for fire-fighting shall comply with the requirements of SABS 090-1972: Code of Practice for Community Protection against Fire, but with deviations from and additions to the code as described in the Red Book ("*Guidelines for Human Settlement Planning and Design*" – see page 33 Chapter 9).

B2.5.2 Fire-risk categories

(a) ***High-risk :*** Dense industrial and commercial areas, central business areas, warehouse areas and residential zone IV.

(b) ***Moderate-risk :*** Industrial areas, residential zone II and III and commercial office buildings in residential areas (not higher than 3 storeys).

(c) *Low-risk: Group 1&2:* Residential zone 1 (gross floor area of buildings plus outside buildings between 100 and 200 m^2)

(d) *Low-risk: Group 3:* Residential zone 1 (gross floor area of buildings plus outside buildings between 55 and 100 m^2)

(e) *Low-risk: Group 4:* Residential zone 1 (gross floor area of buildings plus outside buildings < 55 m^2)

B2.5.3 Location of hydrants

Fire-risk category	Location of hydrants
High-risk	Distance apart **120m** max.
Moderate-risk	Distance apart **180m** max.
Low-risk: Group 1	Distance apart **240m** max.
Low-risk: Group 2	Distance apart **240m** max.
Low-risk: Group 3	Distance apart **240m** max.
Low-risk: Group 4	Distance apart **240m** max.

B2.6 TRUNK MAINS

Trunk mains serving fire areas should be sized for a design flow equivalent to the sum of the design instantaneous peak domestic demand for the area served by it, and the fire flow according to the following table.

Fire-risk category	Minimum design fire flow (l/min)	Maximum number of hydrants discharging simultaneously
High-risk	12 000	All hydrants within a radius of 270m of the fire
Moderate-risk	6 000	
Low-risk: Group 1	900	1
Low-risk: Group 2	500	1
Low-risk: Group 3	350	1
Low-risk: Group 4	N A	N A

B2.7 RETICULATION MAINS

The reticulation system should be designed so that the residual pressure in the reticulation main at any point is within the limits given in section B2.9. The desirable residual pressures applicable during fire-flow conditions are given below:

Fire-risk category	Maximum number of hydrants discharging simultaneously	Minimum flow rate per hydrant (l/min)	Minimum residual head (m)
High-risk	All hydrants within a radius of 270m of any one of fire	1500 (1600 max.)	15
Moderate-risk		1500 (1600 max.)	15
Low-risk: Group 1	1 Hydrant for 2000 units	900	7
Low-risk: Group 2		500	6
Low-risk: Group 3		350	6
Low-risk: Group 4	N A	N A	N A

B2.8 BALANCING OF RETICULATION NETWORKS

To determine the residual pressure at any point in the network, the network has to be balanced by using peak water demand. Any of the acknowledged balancing methods may be used (eg. Hardy-Cross).

B2.9 RESIDUAL PRESSURE

- Maximum head at any point under zero flow conditions = 90m (9 bar)
- Minimum head under instantaneous peak demand = 24m (2.4 bar)
- Minimum head under fire flow conditions: See Section 2.7
- Minimum working pressure at an erf connection = 6 to 8m

B2.10 FLOW VELOCITY IN PIPES

- Minimum: 0,6 m/s
- Maximum: 1,5 m/s
- Recommended: 1,0 m/s

B2.11 VALVES AND SPECIALS

B2.11.1 Gate valves

- Isolating valves should be provided so that not more than 4 valves need to be closed in order to isolate a section of main.
- Maximum distance between valves: 600m.
- Valves should be located at street corners opposite erf boundary (splay) pegs, and intermediate valves opposite the common boundary peg of two erven.
- Where pipes intersect, isolating valves should generally be installed in the smaller diameter branches.

B2.11.2 Air valves

The design engineer must determine the exact position of air valves taking all factors (such as site topography) into account. It can be considered to use fire hydrants as air valves in reticulation networks where possible, but the acceptance of such as design must be confirmed by the Director: Engineering Services. Single air valves can be used in reticulation networks. Double air valves have to be provided on bulk water mains of 200mm dia and higher.

B2.11.3 Scour valves

- In reticulation networks, fire hydrants should generally be positioned so that it can be used as scour valves.
- Provision for scour should be made at the end of all dead-end mains.

B2.12 ERF CONNECTIONS

B2.12.1 Size

The connection pipe for erf connections for dwelling houses should have the following minimum size. For development other than dwelling units metered individually, the connection pipe should be sized according to the specific demand.

a.) Erf connections across roads		
INCOME LEVEL	MINIMUM NOMINAL DIAMETER (mm)	
	SERVING TWO ERVEN	SERVING ONE ERF
Higher	40, branching to 2 x 25	32, reducing to 25 at erf
Middle	40, branching to 2 x 25	32, reducing to 25 at erf
Lower	32, reducing to 20 at erf	32, reducing to 20 at erf

b) Erf connections on near side of roads		
INCOME LEVEL	MINIMUM NOMINAL DIAMETER (mm)	
	SERVING TWO ERVEN	SERVING ONE ERF
Higher	40, branching to 2 x 25	25
Middle	32, branching to 2 x 25	25
Lower	32, branching to 2 x 20	20

c) Public Open Spaces / Parks

ERF SIZE	*ERF CONNECTION NOMINAL DIAMETER (mm)*
≤ 1000m²	*32*
> 1000m²	*50*

d) Comparison of Nominal Diameter and Inside Diameter of SANS ISO 4427: 1996 HDPE pipes

NOMINAL DIAMETER (DN) VS INSIDE DIAMETER (ID) AS PER SANS ISO 4427: 1996	
PE100 PN16	
DN (mm)	*ID (mm)*
20	*15.10*
25	*20.10*
32	*25.60*
40	*32.20*
50	*40.20*

B2.12.2 Location

Erf connections should be located 0,5m from the side boundary and end 0,5m inside the property. Water meters to be installed in the road reserve, as close as possible to the erf cadastral boundary, to give access to meter readers.

B2.12.3 Cover

Minimum cover over erf connections:

- Under roadways: 0,8m
- Otherwise: 0,6m

B2.12.4 Components

Erf connections for residential erven shall consist of the components as shown on the standard detail drawings.

B2.13 DEPTH AND COVER

Minimum depth:

- Under roadways: 900mm cover over pipe
- Elsewhere in road reserves: 800mm cover over pipe
- Servitudes and public open spaces: 600mm cover over pipe

B2.14 BEDDING

Flexible pipes e.g. PVC: according to Drawing LB-2 of SABS 1200 LB.

In special situations, Class A bedding according to Drawing LB-1 may be needed.

B2.15 BACKFILLING

Pipe trenches in road ways shall be backfilled with clean sand to underneath the road layers and compacted to 100 % of MAMDD.

Pipe trenches in other areas than road ways, shall be backfilled with approved backfilling material and compacted to 90% of MAMDD.

B3 MATERIAL SPECIFICATION

B3.1 WATERMAINS

a) Material:

(i) uPVC Class 12 solid wall according to SABS 966, Part 1 with Z-Lock couplings

OR

(ii) HDPE PE 100 PN 16 to SANS ISO 4427

(iii) Where mild steel pipes are used, all mild steel pipes shall after manufacture be hot dip galvanized and coated internally and externally with Plascoat PPA 571 HES, to minimum 0.25mm coating thickness or Carboline 891 (3 coats, minimum 125 microns/coat) to the manufacturers specification.

b) Minimum pressure class for all pipes = 12 bar.

c) Deviations from the above standards shall be submitted to the Director: Engineering Services for approval.

B3.2 VALVES, SPECIALS AND FITTINGS

B3.2.1 Specials and fittings

All specials and fittings (including bends, tee's, reducers, end caps etc. to PVC pipes shall be:

a) ductile iron to EN 12842, fusing bonded thermoplastic coated internally and externally with Plascoat PPA 571 HES, to minimum 0.25 mm coating thickness with EPDM rubber insert seal.

b) stainless steel grade 316

Only stainless steel bolts and nuts shall be used on all fittings such as saddles, flanges, short collar couplings, etc.

All nuts and bolts shall be wrapped in two layers "Denso" tape or similar approved.

All brass fittings shall be SABS approved on manufactured from DZR brass.

B3.2.2 Gate valves and scour valves

Valves shall be Resilient Seal Gate Valves - AVK or similar approved, according to the following specifications:

General Requirements

All Resilient Seal Gate Valves shall be capable of being opened or shut in an emergency under an unbalanced pressure equal to 100% of the specified test pressure and shall be designed to seal drop tight from 0 - 100% of the designed test pressure. All pressure components (Body, Bonnet, Seals etc.) will be legibly marked in a permanent way. Design and manufacture must take place under a Certified Quality System in accordance with ISO 9001 requirements. **RSV MUST BE AS A ZERO LEAKAGE AND ZERO MAINTENANCE VALVE.**

Material & Design Specifications with Motivation and Explanatory Notes

Body and Bonnet:
The valves shall be available in flanged, plain ended and socketed connections and the casting from ductile iron ggg-50 to din 1693.

Wedge:
1) The wedge shall be ductile iron (ggg-50)
2) The wedge shall be fully encapsulated in EDK 70 (EPDM) rubber internally and externally.
3) The valve shall have a tongue and groove guide system, with the groove component located in the wedge. The groove shall be fitted with a plastic shoe.
4) The wedge rubber shall have a shore hardness of seventy (70) and the rubber shall be a minimum of five millimeters (5mm) thick throughout.
5) The wedge shall be clearly and permanently marked to indicate date of manufacture and rubber material used.
6) The wedge shall have a drain hole with a diameter no less than 125% of the spindle diameter

Wedge Nut:
Must be of the "Fixed" type, press fit into the wedge, allowing no movement, and manufactured from dezincification resistant high tensile navy brass.

Guides:
The wedge shall be supported by a tongue and groove guide system, the tongue component being located in the side of the valve body.
No metal to metal contact between gate and guides will be accepted.

Rubber:
1) All rubber shall be ozone stabilized and UV-Resistant.
2) All rubber shall be water works approved

Stem:
1) Spindle shall be Cold Rolled stainless steel, DIN x 20 CR 13
For min. spindle diameters see table 1 on page 6

Stem Sealing:

1) The primary seal shall be a NBR rubber hydraulic seal (manchette type), and the secondary seal at least two NBR O Rings on the inside and two on the outside of a nylon bush. The stem sealing arrangement shall include a UV resistant wiper ring to prevent the ingress of dirt from the outside. See figure 2 on page 6
2) The entire sealing arrangement shall be factory fitted and be maintenance free.

Thrust collar:
The valve shall have a Thrust Collar of Dezincification Resistant Brass CZ 132 to BS 2874. See figure 2 on page 6

Bonnet Bolts:
Bonnet Bolts shall be entirely sunk into the body casting, sealed and protected by reusable hot wax melt. Bolts to be grade 8.8 high tensile steel, zinc coated.

Bonnet Gasket:
The valve shall have a preformed NBR rubber gasket, O-ring type, set in a recess between the Bonnet and Body. The gasket must encircle each bonnet bolt.

Coating:
The valve shall be fusion bonded epoxy coated to DIN 30677 - internally and externally, prior to assembly.
The coating shall have an average thickness of 250 microns.
Manufacturer will have a total corrosion protection plan for their product which will include:

- Grit blasting prior to coating
- Records of coating conditions for every batch
- Full traceability of products used
- Final dry film thickness tests
- Cross cut and impact resistance test results will be available for every batch.

Hydraulic Tests:
Every valve shall be tested (no batch testing allowed) prior to hipping.
Body test: 1.5 x nominal pressure rating.
Seat test: 1.1 x nominal pressure rating.

Approvals:
The valve shall be SABS 664 Approved and carry the SABS mark. The manufacturer shall have The SABS 3000 cycle test done and have a Test Certificate to verify that their product passed the test.

Warranty: The valve shall be backed by a written thirty (30) year replacement warranty when used under normal working conditions.

B3.2.3 Air valves

Vent-o-Mat type or similar approved.
All nuts and bolts shall be wrapped in two layers “Denso” tape or similar approved.

B3.2.4 Fire hydrants

Hydrants shall be AVK underground fire hydrant series 29/388 or similar approved.The following specifications apply:

a) Fully maintainable.
b) Ductile iron construction.
c) 2½” London round thread outlet to BS 750.
d) Exceeds flow requirements:
   i. Kv = 92 minimum 2000l/min
   ii. Kv = 96 actual 2092 l/min
e) Corrosion resistant construction, compliant with BS EN 1074-6 for disinfection products.
f) Universal drilled inlet flange BS EN 1092:1997, BS 10 Table D/E.
g) Inlet is of a proprietary type.
h) Auto-frost drain valve as standard.
i) Fixed, draining stopper.
j) Kite Marked.
k) Low weight design.
l) 30 Year Warranty
m) WRAS approved.

B3.3 ERF CONNECTIONS

a) Pipes:

(i) Smaller than 50mm Ø: HDPE PE100 PN16 to SANS ISO 4427:1996

(ii) Bigger than 50mm Ø: uPVC, Class 12 according to SABS 966, Part 1
Or
HDPE PE100 PN16 to SANS ISO 4427:1996

b) Saddles: Heavy Duty (Magnum) Class 16 Polypropylene with brass DZR insert with grade 316 stainless steel nuts and bolts wrapped with two layers “Denso” tape.

d) "Ball valve / Ballcocks": Ballvalves shall be of DZR brass material and suitable for a working presuure of 1.6MPa with ends screwed BS pipe thread. These valves shall be of the Cobra C15; C20; C25 (municipal ballcocks) only.

e) Markers: As shown on standard details.

f) Water Meters: Engineer to provide a sample of the proposed water meter for approval by the Manager: Water Service, prior to ordering and installation.

B3.4 VALVE CHAMBERS

a) Brickwork: SABS approved bricks.

b) Mortar: 1:3 cement/sand.

c) 1:2 Cement/sand mortar to keep frame in position.

d) Cover and frame for valves:
Heavy Duty Type 3A Ductile Iron cover and Frame Bell Toby with telescopic pin as an anti-theft mechanism for cover.

e) Cover and frame for fire hydrant chambers:
Ductile Iron Class C250 (250kN) (SANS 50124): Saint Gobain Hydrex Z-300x400-C (or similar approved) sliding cover hydrant box

B3.5 THRUST BLOCKS

Concrete for thrust blocks: 20 MPa with 19mm aggregate. Standard detail drawings provided in this document are a guideline only, all thrust blocks are to be designed for the site specific geotechnical conditions by the appointed Engineer.

B3.6 BEDDING

Selected granular material shall be material of a granular, non-cohesive nature that is singularly graded between 0,6mm and 19mm, is free-draining, and has a compactibility factor (as determined by the test given in Section LB of Part 3 of SABS 0120) not exceeding 0,4.

Selected fill material shall be material that has a PI not exceeding 6 and that is free from vegetation and from lumps and stones of diameter exceeding 30mm.

B3.7 BACKFILLING

In areas subject to loads from road traffic, backfill shall have a PI not exceeding 6 and a minimum CBR of 15 at specified density.

B4 GENERAL PROCEDURES

B4.1 TESTING

B4.1.1 General

Testing shall be carried out according to Section 7 of SABS 1200 L and LF and in the presence of an official of the Water Services Department of the Municipality.

B4.1.2 Standard hydraulic pipe test

B4.1.2.1 General

Hydraulic testing shall commence only after permanent thrust blocks have attained their specific strength, i.e. after 28 days.

B4.1.2.2 Visible leaks

The field test pressure shall be maintained for at least 3 hours during which period all pipes, specials, joints and fittings shall be carefully inspected for leaks.

B4.1.2.3 Permissible leakage rates

The test pressure shall be maintained for a further period of 1 hour after the completion of the test in B4.1.2.2, during which time the volume of water required to be pumped into the pipeline for maintenance of the pressure shall be measured. The volume (in litres) shall not exceed the value calculated from the applicable of the following formulae:

uPVC pipes:

0,01 x diameter of pipe (mm) x length of test section (km)
x square root of test pressure (MPa)

SECTION C

DESIGN GUIDELINES AND MINIMUM STANDARDS FOR SEWER DRAINAGE

INDEX

C1 PLANNING ASPECTS

C1.1 MASTER PLANNING

The planning of the internal sewer reticulation for a new development shall be in agreement with the master planning for sewer reticulation for the entire area. In this regard, it is expected of the developer's consulting engineer to determine the average daily sewer flow from the new development and to submit it in the Engineering report.

The Municipality's specialist consulting engineers will, should the Director: Engineering Services consider it necessary (on the cost of the Developer), investigate the effect of the proposed on the existing and make a recommendation regarding upgrading any existing infrastructure where necessary.

C1.2 LOCATION OF SERVICES IN ROAD RESERVES

Sewer lines are generally located within road reserves at a distance of 1,5 m from the road reserve boundary. Where mid-block sewers are allowed, it should be located at 1,2 m from the communal erf boundary.

The following drawings show the typical layout of services within different road reserve widths and should be used as a guideline:

SG2	Typical layout of services in 20m road reserves
SG3	Typical layout of services in 16m road reserves
SG4	Typical layout of services in 13m road reserves
SG5	Typical layout of services in 10m road reserves

C2 DESIGN STANDARDS

C2.1 AVERAGE DAILY FLOW

Note: Where Average daily flow is given "per hectare", it refers to the area of the erf itself.

Type of development	Average daily flow
Residential *Zone I*	
One house plus outside building	
per erf (FSR < 0,5)	
Erven $\leq$ 600 m^2	500 - 1 000 l/erf/day
Erven = 700 m^2	500 - 1 000 l/erf/day

	Erven = 800 m²	550 - 1 100 l/erf/day
	Erven = 1 000 m²	600 - 1 200 l/erf/day
	Erven = 1 200 m²	650 - 1 300 l/erf/day
	Erven = 1 500 m²	700 - 1 400 l/erf/day
	Erven = 2 000 m²	700 - 1 400 l/erf/day
Residential (continue)		
	Zones II and III	500 - 1 000 l/dwelling unit/day
	Multiple dwelling units per	
	erf; up to 3 storeys high	
	(FSR = 0,5 - 1,0)	
	Zone IV	450 - 700 l/dwelling unit/day
	Multiple dwelling units per	
	erf; 4 storeys and higher	
	(FSR > 1,0)	
Business areas		10 kl/ha/day
Offices	FSR = 0,2	6 kl/ha/day
	FSR = 0,3	9 kl/ha/day
	FSR = 0,4	12 kl/ha/day
Government and Municipal		400 l/100 m² gross floor area / day
Industries	Light	12,5 kl/ha/day (Engineer must compare this with actual records of similar developments to confirm if it is applicable)
	General	25 kl/ha/day (Engineer must compare this with actual records of similar developments to confirm if it is applicable)
	Water intensive ("wet")	Special investigation necessary
Day hospitals, Hotels		
	FSR = 0,2	12 kl/ha/day
	FSR = 0,3	17,5 kl/ha/day
Schools	Day schools < 2 ha	15 kl/ha/day
	> 2 ha <10 ha	12,5 kl/ha/day
	> 10 ha	10 kl/ha/day

Boarding schools		As for day schools
		+ 150 l/boarder/day
Churches		2 000 l/day
Places of entertainment	FSR = 0,2	16 kl/ha/day
	FSR = 0,3	25 kl/ha/day
Developed parks	> 2 ha	15 kl/ha/day
	> 2 ha < 10 ha	12,5 kl/ha/day
	> 10 ha	10 kl/ha/day
Public open spaces		Site specific

FSR = Floor Space Ratio = (Total floor area) ÷ (Total erf area)

Note: Where upper and lower limits are provided, the upper limit applies to higher income areas, while the lower limit applies to lower income areas.

C2.2 PEAK FLOW

Peak flow rate = average daily flow rate X peak factor.

If population < 1500, Peak factor = 2.5
If population > 1500, Peak factor shall be read from Figure C1 in the Red Book

C2.3 DESIGN FLOW RATE

An allowance of 15 % of peak flow shall be made for infiltration of ground water and rain into sewer systems.

Design flow rate = peak flow rate x 1.15

C2.4 FLOW FORMULAE

Sewers shall be designed to flow full for the design flow rate according to C2.3.

An acknowledged flow formula shall be used for the calculation of flow in sewers. Examples are :

- Manning (n=0.012)
- Colebrook-White (Ks=0.6)

C2.5 MINIMUM SIZE OF SEWERS

- Sewer mains: 160mm Ø (nominal diameter)
- Erf connections: 110mm Ø (nominal diameter)

C2.6 MINIMUM FLOW VELOCITY IN SEWERS

- 0,7 m/s (full bore)

C2.7 MINIMUM GRADIENTS OF SEWER MAINS

Minimum gradient for 160 mm pipes:	
Number of dwelling units:	
Less than 10	1 : 100
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

C2.8 DEPTH AND COVER

- In road reserves: 0,8m cover
- On erven, in public open spaces and in servitudes: 0,6m cover

C2.9 ERF CONNECTIONS

C2.9.1 Location

The end of the erf connection shall be as follows:

- 1.0m inside erf boundary
- 1.0m from side boundary

C2.9.2 Vertical alignment

The following aspects should be considered when testing the sewer drainage of an erf:

- At least 70% of an the erf shall be drained at the connection point.
- Minimum grade for erf sewers of 1:60.
- The lowest and furthest ends of the erf and the probable route of the site sewer.
- The difference in diameters between the connection and the main pipe when crown-to-crown connection is used.

C2.9.3 Depth

The cover over erf connections shall be at least 600mm at the end cap.

C2.9.4 Markers

As shown on standard details.

C2.10 BEDDING

As for flexible pipes to Drawing LB-2 of SABS 1200 OR, where applicable: Class C according to Drawing LB-1 of SABS 1200 LB (except for special situations where Class A is needed).

C2.11 BACKFILLING

Pipe trenches in road ways shall be backfilled with clean sand to underneath the road layers and compacted to 100 % of MAMDD.

Pipe trenches in other areas than road ways, shall be backfilled with approved backfilling material and compacted to 90% of MAMDD.

C2.12 MANHOLES

C2.12.1 Location and spacing

Manholes should be located at all junctions and at all changes of grade and/or direction.

The maximum distance between manholes shall not exceed 90m.

C2.12.2 Benching

An area of benching should be provided to permit a man to stand easily and without danger to himself.

Manhole benching should have a grade equal to the biggest of the following:

- 50mm

- grade of incoming pipe
- grade of outgoing pipe.

All pipe connections to be crown to crown (excl backdrops).
Fibre cement or vitreous clay channels to be used as half round channels.

C2.13 SEWER PUMP STATIONS

C2.13.1 Size of rising main

- Minimum: 110mmØ

C2.13.2 Flow velocity in rising main

- Minimum: 0,7m/s
- Maximum: 2,5m/s

C2.13.3 Gradient

Wherever practicable, rising mains should be graded as to avoid the use of air and scour valves.

C2.13.4 Stilling chambers

Stilling chambers should be provided at the heads of all rising mains and should be designed that the liquid level always remains above the level of the soffit of the rising main where it enters the chamber.

C2.13.5 Sumps for pump stations

Over and above the capacity available at normal top water level, the pump station sump shall have a minimum emergency storage capacity of 4 hours at the average flow rate.

C2.13.6 Pumps

Pump stations shall be designed:

- to restrict pump starts to a maximum of 6 per hour;
- to avoid flooding of the dry well and/or electrical installations by stormwater or infiltration;
- to protect pumping equipment.

C2.13.7 Standby pump

- A standby pump with capacity equal to that of the biggest service pump

shall be provided and shall immediately activate when the service pump fails.

- In certain situations, an emergency generator may be required.
- A connection point, suitable for connecting of the Municipality's mobile standby pump, shall be provided on the rising main.

C2.13.8 Safety

- All sumps and dry wells should be adequately ventilated.
- Handrails should be provided to all landings and stair cases and to the sides of open sumps.
- Skid-proof surfaces should be provided to all floors and steps.
- The layout of the pumps, pipework and equipment should be such as to allow easy access to individual items of equipment without obstruction by pipework.

C3 MATERIAL SPECIFICATION

C3.1 SEWER MAINS

uPVC, Class 34 (heavy duty) according to SABS 791. The SABS mark shall appear on each pipe section.

C3.2 ERF CONNECTIONS

As for sewer mains.

C3.3 MANHOLES

a) Types:

- Fibre cement solid shaft manholes
- Precast concrete manholes
- Brick manholes (not preferred - permission to be obtained from Water Services Department before selecting this type)

In areas with a high water table, only type 1 shall be acceptable.

b) Concrete for in situ base slabs:

- 25 MPa/19mm aggregate

c) Aggregate for concrete:

- dolomitic.

d) Plaster:

- 1:3 cement mortar (where applicable, considering FC manholes the preferred option)

e) 1:2 cement mortar to keep cover and frame in place.

f) Cover slabs:

- Where precast cover slabs are not provided, it has to be of 25MPa/19mm reinforced concrete.

g) Benching:

- 15 MPa concrete with steel float finish.

h) Half round channels:

- Vitreous Clay or fibre cement

i) Covers and frames:

- Hinged Ductile Iron: Saint Gobain Securex Z-600 D (SANS 50124 Class D400) or similar approved. Hinge to be fixed to frame and non removable.
- 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.

i) Step irons:

- Polymeric polypropylene with a 12 mm Ø high tensile strength steel core placed at 300mm centres and staggered left and right at 300mm centres.

j) Joints:

- Precast concrete manholes: waterproof interlocking joints by setting in 1:2 cement mortar and wrapping externally with two layers 300mm denso tape or similar approved.

k) A flexible connection for all incoming and outgoing pipes should be provided according to Drawing SABS 1200 LD-2 (and the standard drawings of this document) and with pipes and couplings as in C3.1 and C3.2 of this document.

l) All manholes shall be water tight.

m) Manholes in undeveloped areas to be 200mm above NGL.

C3.4 BEDDING

Selected granular material shall be material of a granular, non-cohesive nature that is singularly graded between 0,6mm and 19mm, is free-draining, and has a compactibility factor (as determined by the test given in Section LB of Part 3 of SABS 0120) not exceeding 0,4.

Selected fill material shall be material that has a PI not exceeding 6 and that is free from vegetation and from lumps and stones of diameter exceeding 30mm.

C3.5 BACKFILLING

In areas subject to loads from road traffic, backfill shall have a PI not exceeding 12 and a minimum CBR of 15 at specified density.

C3.6 MARKERS

As shown on standard details.

C4 GENERAL PROCEDURES

C4.1 TESTING

Tests for sewers shall be carried out according to Part 7 of SABS 1200 LD.

An approved air testing machine shall be used to raise the gauge pressure in the section of the pipeline under test to 3,75 kPa. After a 2 minute stabilization period, the pressure shall be reduced to 2,5kPa. The machine shall then be switched off and the time taken for the pressure to drop from 2,5kPa to 1,25kPa shall be determined.

The time taken shall be at least the applicable of the following values:

Nominal diameter of pipe (mm)	Minimum time (in minutes) taken for pressure to drop from 2,5 kPa to 1,25 kPa
100	2
150	3
200	4
225	4,2
250	4,5
300	6
375	7,5
450	9
600	12
750	15

SECTION D

DESIGN GUIDELINES AND MINIMUM STANDARDS FOR STORMWATER DRAINAGE

INDEX

D1 PLANNING ASPECTS

D1.1 MASTER PLANNING

The planning of a new stormwater drainage system for an area, e.g. a new development, should be done in accordance with the "Stormwater Masterplan" of the Municipality. Any proposed deviations from the Masterplan should be brought to the attention of the Director: Engineering Services and be properly motivated.

Where the "Stormwater Masterplan" does not provide any information regarding future stormwater structures, the following aspects should be investigated and addressed in the Engineering report referred to in Section A:

a) Efficiency of the existing main stormwater drainage in handling the current flood drainage from the catchment-area in which the development lies.

b) Efficiency of the existing main stormwater drainage in handling the flood drainage from the catchment-area after completion of the additional development.

c) Efficiency of the existing main stormwater drainage in handling the flood drainage from a fully developed catchment-area.

D1.1.1 Design Principles

The following principles must be incorporated in the stormwater drainage design:

a) that the geometric design of the roads and/or parking areas ensure that no trapped low-points are created with regard to stormwater management. All stormwater to be routed to the nearest formalized municipal system;

b) that the design engineer needs to apply his/her mind to ensure a design that will promote a sustainable urban drainage system which will reduce the impacts of stormwater on receiving aquatic environments;

c) that no disturbance to the river channel or banks be made without the prior approval in accordance with the requirements of the National Water Act and the National Environmental Management Act;

d) that the consulting engineer, appointed by the "Developer", analyses the existing stormwater systems and determine the expected stormwater run-off for the proposed development, for both the minor and the major storm event. Should the existing municipal stormwater system not be able to accommodate the expected stormwater run-off, the difference between the pre- and post-

development stormwater run-off must be accommodated on site, or the existing system must be upgraded to the required capacity at the cost of the "Developer" and to the standards and satisfaction of the Directorate: Engineering Services. The aforementioned stormwater analysis is to be submitted concurrent with the detail services plans;

e) that for larger developments, industrial developments or developments near water courses a stormwater management plan for the proposed development area, for both the minor and major storm events, be compiled and submitted for approval to the Directorate: Engineering Services.

f) that the approved management plan be implemented by the "Developer", at his/her cost, to the standards of the Directorate: Engineering Services. The management plan, which is to include an attenuation facility, is to be submitted concurrent with the detail services plans;

g) that overland stormwater escape routes be provided in the cadastral layout at all low points in the road layout, or that the vertical alignment of the road design be adjusted in order for the roads to function as overland stormwater escape routes. If this necessitates an amendment of the cadastral layout, it must be done by the "Developer", at his/her cost, to the standards of the Directorate: Engineering Services;

h) that in the case of a sectional title development, the internal stormwater layout be indicated on the necessary building plans to be submitted for approval.

i) that no overland discharge of stormwater will be allowed into a public road for erven with catchment areas of more than 1500m² and for which it is agreed that no detention facilities are required. The "Developer" needs to connect to the nearest piped municipal stormwater system with a stormwater erf connection which may not exceed a diameter of 300mm.

D1.2 INTERNAL STORMWATER DRAINAGE SYSTEM

Together with the overhead planning (external planning), the new stormwater drainage system should also be planned internally. The internal drainage system for an area should exist of a primary (minor storms) and a secondary (major storms) system. The primary drainage system contains the underground conductors such as pipes and culverts, as well as small drainage canals and should be able to drain less heavy flood drainage. The secondary system exists of stormwater drainage in road carriage way and overland during heavy rainstorms when the capacity of the primary system is exceeded.

The Developer's consulting engineer shall identify the stormwater escape routes, as well as any area needed for a retention facility, and provide this

information in the Engineering report to ensure that provision was made for this in the sub-division.

D1.3 LOCATION OF SERVICES IN ROAD RESERVES

The following drawings show the typical layout of services for different road reserve widths and should be used as a guideline:

SG2	Typical layout of services in 20m road reserve
SG3	Typical layout of services in 16m road reserve
SG4	Typical layout of services in 13m road reserve
SG5	Typical layout of services in 10m road reserve

D2 DESIGN STANDARDS

D2.1 CALCULATIONS FOR RUNOFF

Stormwater runoff shall be calculated with a recognised and suitable hydrological method. Examples are the rational method, the SCS-method and the synthetic hydrograph method.

D2.2 MINOR SYSTEM

The minor stormwater system shall be designed to convey the runoff of storms with the following recurrence intervals without flooding of the system.

Land use	Recurrence interval
Residential	2 years
General commercial and industrial	5 years
High value central business districts	10 years

D2.3 MAJOR SYSTEM

The major stormwater system shall be designed to convey the runoff of storms with a recurrence interval of 1:50 years without damage to property, injuries or loss of life. Systems draining trapped lows to accommodate the 1:100 year storm.

During major storm events, the traffic function of residential and lower order roads is interrupted and the full stormwater carrying capacity of the roads can be utilized. The following must be adhered to:

- No inundation beyond road reserve boundaries.'
- The maximum allowable inundation above road crown during major storm events is 150mm.

D2.4 MANHOLES

a) Manholes shall be located where the pipe changes in slope, direction pipe size or at end points.
b) The maximum distance between manholes is 90m.
c) Pipe connections to be crown to crown.
d) Maximum chimney height to be three brick courses (260mm).

D2.5 CATCHPITS AND KERB INLETS

a) Minimum diameter for connection pipes is 375mm.
b) Gradient of catchpit connections should not be less than 1:60.
c) Minimum connection length is 15m.
d) Number of kerb inlets and catchpits to be kept to a minimum. Maximum flow capacity of road cross-section to be used to determine position of catchpits and kerb inlets.
e) Inlet kerbs to be of same profile and height as adjoining kerbs.
f) Catchpits and kerbs inlets must be positioned to avoid property driveways
g) Maximum length of overland flow to be 120m.
h) Catchpits on surfaced roads to have side inlets, and on unsurfaced roads to have grid inlets.
i) Catchpits to be benched, no silt traps to be provided.
j) Precast catchpits are not approved.
k) Catchpit to catchpit connections are not permitted
l) Combination catchpit / manholes are not permitted.
m) The location of catchpits along a road is dependent on :
    i. The catchment area which drains to the road.
    ii. The inlet capacity of the catchpits.
    iii. The maximum allowable encroachment of stormwater runoff on the road.
n) Energy dissipation modification of kerb inlets are required when flow velocity exceeds 3m/s in roadside channels.
o) The inlet capacities of catchpits with 1,6m wide side inlets of the standard barrier type are dependent on the gradient along the road.

The following can be used as a guideline:

Gradient along road (%)	Inlet capacity (l/s)
0,4	54
1,0	43
2,0	37
3,0	27
4,0	22
5,0	19

The maximum allowable encroachment on the road is linked to the hierarchy of the road :

Class 4 - One lane in each direction free of surface water
Class 5a - One lane free of surface water
Class 5b and lower - No limitation on the width of channel flow.

D2.6 PIPES AND BOX CULVERTS

a) Minimum size 375 mm Ø.
b) Bedding for pipes to be Class B (SABS 1200 LB), except for special situations where Class A bedding is needed.
c) Bedding for culverts with precast concrete bases to 75mm thick layer of 6mm stone under precast base.
d) Minimum Slope to be 1:250 (0.4%).
e) Minimum full flow velocity to 0.9m/s.
f) Maximum Velocity to be 3.5m/3.
g) Where practically possible, minimum cover 750mm and 1000mm at road intersections.
h) Free flowing connections (i.e. 45 degree connections) should be promoted where possible and 90 degree connections to be avoided.
i) Box culverts to have dished inverts
j) Minimum box culverts height to be 600mm

D2.7 SUBSOIL DRAINAGE

a) Pipe type to be uPVC to SABS 1601, “Corflo” or similar approved.
b) Minimum drainage pipe diameter to be 100mm, drainage medium to be 19mm stone complying with SABS 1083.
c) Minimum internal manhole diameter to be 750mm.

d) Maximum manhole spacing to be 60m.
e) Subsoil drains must be provided in all areas with a high water table in the wet season, to drop the water table at least 800mm below the road surface.
f) Subsurface drains to be constructed on upstream side of the road reserve directly behind the kerb line.
g) Sausage and fin type subsoil drains are not permitted.

D2.8 OPEN STORMWATER CHANNELS

a) Open stormwater channels are not preferred and should only be installed where there are no appropriate alternatives.
b) Acceptable linings include; stone pitching, grouted stone pitching, concrete, armourflex or similar approved.
c) Lined Channels, minimum longitudinal slope to be 0.25% and maximum flow velocity to be 1.5m/s.
d) Unlined Channels, minimum longitudinal slope to be 0.5% and maximum flow velocity to be 1m/s.
e) Paved side drains are required on unsurfaced roads when the gradient of the drain is greater than 3% and less than 1%.

D2.9 RETENTION PONDS

a) The maximum water depth in a retention pond during the storm shall not exceed 800mm.
b) Retention ponds shall preferably have alternative functional land uses e.g. public open space or sports grounds.
c) Retention ponds shall be designed to totally drain after the storm has passed and therefore should be dry ponds.
d) All retention ponds shall be grassed and contain a low-flow channel for minor storm durations. After the grass has been established, it shall be wet and mowed until 75% ground cover has been reached.
e) Subsoil drains to be installed to allow efficient drainage.
f) Criteria:
    i. Minimum bottom slope : 1:200
    ii. Maximum embankment slope : 1:4

D3 MATERIAL SPECIFICATION

D3.1 PIPES AND BOX CULVERTS

a) Reinforced concrete pipes according to the relevant SABS standard with Spigot and Socket joint type.
b) Pipe class to be:
    i. in road reserves : Class 100 D
    ii. elsewhere : as designed
c) Box culverts to be Reinforced concrete, Class 3 according to SABS 986.

D3.2 BEDDING AND BACKFILL

All bedding to conform to relevant SABS 1200 standard specification.

D3.3 MANHOLES, CATCHPITS AND HEADWALLS

a) Brickwork with SABS approved NFX (non facing extra) CLAY bricks.
b) Manholes to be standard brick manholes with precast top slabs. Alternatively precast ring type manholes (minimum 1050 mm diameter) may be used. Step irons to be "Copolimer polypropylene" with a 12mm dia. high tensile strength steel core or similar approved.
c) Manhole covers and frames to be ductile iron conforming to the requirements of SANS 50124 (Duty Class D400) hinged with non removable cover or lockable type "SecuRex Z-600-D" or similar approved. The hinge of the lid must be positioned on the side of the approaching traffic in the lane.
d) Catchpits in surfaced roads to be side inlet kerb type with ductile iron (Duty Class B125) non removable hinged or lockable cover and frame conforming to the requirements of SANS 50124 (Aksess: Saint Gobain range or similar approved) cast into precast concrete cover slab.
e) Where the use of grid inlets are unavoidable, the grid inlets shall be a non-removable hinged cover and frame able to withstand the heavy-duty loading requirements of SABS 558 (Sterling Engineering or similar approved).
f) Concrete for base slabs : 25 MPa / 19 mm aggregate.
g) Concrete for cover slabs : 25 MPa / 19mm aggregate.
h) Mortar to fix frame onto cover slab - 1 : 2 cement mortar.
i) Benching : 15 MPa / 6mm with steel float finish.
j) Plaster : 1 : 3 cement mortar.

D4 GENERAL PROCEDURES

In situations where a river or stream flows through a new development or borders it, the Developer's consulting engineer shall calculate the 1:50 year flood line and show it on the layout plans. The Director: Engineering Services shall not approve any construction drawings if this information is not provided.

SECTION E

DESIGN GUIDELINES AND MINIMUM STANDARDS FOR ROADS

INDEX

E1 PLANNING ASPECTS

E1.1 GENERAL

The road reserve is determined in accordance with the class of road and from the minimum requirements to accommodate all surface and underground services, e.g. stormwater, sewers, water, electrical and Telkom services. This width may vary in the length of a road in order to cater for special features such as bus bay-s and intersection widening. Curve widening must be used where necessary.

Finished road levels should be designed such that abutting erven can drain freely onto the roads. The road network must be designed to accommodate run-off water from erven. Erven to be shaped to prevent any ponding.

Localised (trapped) low points in the roads must be avoided and where inevitable the major storm must be accommodated in the underground reticulation or overland across pre-determined and approved areas such as servitudes and public open spaces.

Requirements for the installation of services in road reserves will vary according to site conditions, road layout, provision of trees and location of Electrical and Telkom services.

E1.2 ROAD HIERARCHY

Sensible planning of new roads within the boundaries of Stellenbosch Town requires proper knowledge of the existing roads network as well as the South African Road Hierarchy in general.

South African roads are classified into 5 types according to their function.

Class 1 : Trunk roads - (National and regional distributors)
These are predominantly rural roads whose main function are to facilitate regional traffic distribution (inter-city movement). These roads include freeways, expressways, dual carriageways and single carriageway main roads.

e.g : R44 (Strand road en Klapmuts road)
R304 (Koelenhof road)

Class 2 : Primary distributors - This class of road forms the primary network for the urban areas as a whole. The function of these roads are to distribute traffic of high volumes and high speeds around the town.

e.g : R44 between Paradyskloof and Green Oaks
R310 between Idas Valley and Tennantville

Class 3 : District distributors - These roads distribute traffic between the residential, industrial and business districts of a town and form the link between the primary network (Class 2 roads) and the roads within residential areas.

e.g : Merriman Avenue, Van Rheede Street, Paradyskloof Road, Martinson Street, Cluver Way

Class 4 : Local distributors - Residential through-roads which distribute traffic within communities and link district distributors (Class 3 roads) and access roads (Class 5 roads). Commuter bus services are routed along this class of road which should generally be open-ended.

e.g : Merriman Avenue, Van Rheede, Paradyskloof Road, Martinson Street, Cluver Way

Class 5 : Residential access roads - These roads give people direct access to land within neighbourhoods and include the following :

5a : Residential access collector
5b : Residential access loop
5c : Access cul-de-sac
5a : Access way
5e : Access court
5f : Access strip

e.g : Class 5a - Saffraan Avenue (Die Boord)
Brandwacht Street (Brandwacht)
Long Street (Cloetesville).

Class 5b - All residential streets with a lower hierarchy than 5a, excluding cul-de-sacs.

Class 5c - Cul-de-sacs.

Class 5d,e,f - These road classes can be found at private developments e.g. access to town houses and access to parking areas at blocks of flats.

From the above description of the different road classes and the examples, it can be seen that roads created within new developments, are predominantly of the Classes 4 and 5. Roads of higher hierarchy form part of the primary roads network which are to be planned by the traffic consultants appointed by the Town Municipality.

The design guidelines and minimum standards provided in this section are

applicable only to Class 4 and Class 5 roads. Planning and design of roads with a hierarchy higher than Class 4, shall be executed by the Town Municipality's traffic consultants in accordance with the Town Structure Plan.

E1.3 ROADWAY WIDTHS

The following table gives an indication of the roadway widths to be provided for each type of road. The specific roadway width within the given range shall be motivated to the Director: Engineering Services.

Road Type		Roadway width
Class	Description	
4	Local distributor	6,0 - 7,4m
5a	Residential access collector	5,0 - 6,0m
5b	Residential access loop	4,5 - 5,5m
5c	Access cul-de-sac	4,5 - 5,5m
5d	Access way	3,0m minimum with passing bays where needed
5e	Access court	3,0m minimum at pinch point
5f	Access strip (panhandle)	3,0m minimum for single erf; 4,0m if shared by two erven

E1.4 ROAD RESERVE WIDTHS

The following table gives an indication of the road reserve widths to be provided for each type of road.

Road Type		Road reserve width (m)
Class	Description	
4	Local Distributor	16
5a	Residential access collector	13
5b	Residential access loop	10
5c	Access cul-de-sac	10
5d	Access way	10
5e	Access court	6
5f	Access strip (panhandle)	4

E2 DESIGN STANDARDS

E2.1 DESIGN SPEED

The following design speeds are applicable on roads within the municipal boundaries of Stellenbosch.

Road Type		Design speed	Max. speed
Class	Description	(km/h)	(km/h)
4	Local distributor	50	60
5a	Residential access collector	-	40
5b	Residential access loop	-	30
5c	Access cul-de-sac	-	15 - 20
5d	Access way	-	15 - 20
5e	Access court	-	15 - 20
5f	Access strip (panhandle)	-	15 - 20

E2.2 CROSSFALL

The crossfall on Class 4 and Class 5 roads are dependent on the function they have in the secondary stormwater network. By increasing the crossfall of a road, the stormwater capacity increases for the same kerb and percentage flooding of the roadway.

The crossfall on roads shall be within the following range :

Class 4 roads : 2 - 2,5 %
Class 5 roads : 2 - 3 %

E2.3 INTERSECTIONS

E2.3.1 Spacing (Centre line to centre line)

The following table gives a summary of the recommended intersection spacing for Class 4 to Class 5b roads :

Road type	Minimum intersection spacing	
	Adjacent	Opposite
Class 4	80 - 90m	65m
Class 5a	60m	30m
Class 5b	40m	20m

E2.3.2 Approach

The angle of connection in a horizontal level should preferably be 90°, but never smaller than 70°.

The straight approach distance between the intersection and the first horizontal curve on the approach should preferably be 3 passenger vehicle lengths.

The maximum vertical gradient for the approach to an intersection is 5 % for a distance of at least 20 m (positive or negative gradients).

2.3.3 Bellmouth radii

The recommended kerb radii at bellmouths are :

Through-road		Lower order road			
Class 4		Class 5a with roadway widths :			
		6m		5.5m	
		Recommended radius (m)			
	8m	10		12	
	7.4m	10		12	
	6.8m	12		12	
Class 5a		Other Class 5 roads with roadway widths :			
		5.5m	5m	4.5m	3m
		Recommended radius (m)			
	6m	4.2 - 6	4.2 - 8	8 - 10	10
	5.5m	4.2 - 8	6 - 8	8 - 10	10
Other Class 5 roads with roadway width :	5.5m	4.2 - 8	4.2 - 8	6 - 8	10
	5m	4.2 - 8	4.2 - 8	6 - 8	10

Minimum centre line radius for class 5 roads with deflection angles between 60° and 90°.

Road type		Minimum centre line radius
Access collector	5a	15m
Access loop	5b	10m
Access cul-de-sac	5c	10m
Access way	5d	10m

For deflection angles <50°, a minimum radius of 30 m shall be used.

E2.4 CLEARANCE

The recommended minimum horizontal clearance in the following table is based on a Class 4 road and a design speed of 50 km/h.

Height of object on verge	Minimum clearance where crossfall is		
	<2.5 %	2.5 % - 4.0 %	>4.0 %
< 3m	0.5m	0.6m	0.6m
> 3m	0.5m	0.6m	0.8m

* Clearance is measured from the face of kerb to the surface of the object closest to the roadway.

E2.5 VERTICAL GRADIENTS

E2.5.1 Minimum gradient : 0,4 %

E2.5.2 Maximum gradients :

Road Type	Favoured maximum gradient	Maximum gradient over short distances	
		Gradient	Distance
Class 4	7 %	10 %	100m
Class 5a	10 %	12.5 %	70m
Class 5b	12 %	16 %	50m
Class 5c	10 %	12 %	50m
Class 5d	12 %	15 %	30m
Class 5e	4 %	N A	N A
Class 5f	12 %	15 %	30m

The last 20m of an approach to a turning area, including the turning area, shall not have a gradient of more than 5%.

E2.6 VERTICAL CURVES

Minimum vertical curve lengths :

Design speed (km/h)	Minimum curve lengths for :	
	Class 4	Class 5
20	-	20m
30	-	20m
40	60m	30m
50	80m	30m
60	100m	40m

E2.7 TURNING CIRCLES (Only applicable to Class 5 roads)

- round (conventional or off-set type)
- T-, Y- or L-shaped "hammer heads"

Basic dimensions should be according to Figures 5.26 and 5.27 in *"Guidelines for the provision of Engineering Services and Amenities in Residential Township Development"*.

Turning circles should be designed according to the requirements of the Red Book taking into account the type of traffic, refuse vehicles etc. that may use the facility

Cul-de-sacs should be avoided wherever possible or limited to 45m in length where planned.

E2.8 PARKING

The following table serves as a standard for parking bays to be provided at new developments:

Land use	Parking bays provided
Residential : (Zones II, III en IV)	
Dwelling unit of 1 habitable room	1.0 bays / unit
Dwelling unit of 2 habitable rooms	1.0 bays / unit
Dwelling unit of 3 habitable rooms	1.25 bays / unit
Dwelling unit of 4+ habitable rooms	1.5 bays / unit
Visitors	0.5 additional bays / unit
Hotels	1.0 bays / room + 10 bays / 100m²
Guest houses	0.6 bays / room
Old-age homes, etc.	0.3 bays / room

E2.9 KERBING AND CHANNELING

For the purpose of uniformity and to simplify maintenance, the choice of kerbs and channels to be used are limited to the following : (refer to Standard Details for dimensions and construction details)

Barrier kerb : Type BK2
Barrier kerb : Type BK2 & C1
Mountable kerb : Type CK5
Mountable kerb : Type MK10
Mountable kerb : Type MK7

E2.10 SIDEWALKS

Minimum width = 1,5m
Recommended crossfall = 3 % towards road
Minimum structural design = 75 mm gravel wearing course compacted to 93% MAMDD.

In certain instances it may be required to gravel both sides of the road, i.e.

the road verge, up to the road reserve boundary. Maximum slope of verge = 8% (where required due to topography)

Landscaping and planting of trees on sidewalks or verges of roadways are to be in line with Municipality's guidelines. Where permitted, landscaping should not negatively affect vehicle sight distances and should not cause obstructions to pedestrians and cyclist.

E2.11 EXCAVATION AND FILL SLOPES

Excavation and fill slopes for roadworks shall not be steeper than 1 in 3. If this standard cannot be met, a retaining structure should be erected.

E2.12 STRUCTURAL DESIGN

E2.12.1 Categories

UA = Class 1 and 2 roads
UB = Class 3 and 4 roads
UC = Class 5a and 5b roads
UD = Class 5c and 5f roads

E2.12.2 Design period

Category	Structural design period (years)
UA	20
UB	20
UC	20
UD	N A

E2.12.3 Design traffic

The cumulative effect of individual axle loads on a road are expressed as the number of equivalent 80 kN single axle loads (E80's).

Classification of traffic for structural design:

Traffic classes	Cumulative equivalent traffic (E80s/lane)	Description
ER	< 0.05 X 10^6	Residential roads
E0	0.05 - 1.2 x 10^6	Lightly trafficked collector roads, very few heavy vehicles.
E1	0.2 - 0.8 x 10^6	Collector roads and lightly trafficked bus routes, mainly cars and light delivery vehicles.
E2	0.8 - 3.0 x 10^6	Medium volume traffic, bus routes and arterial roads.
E3	3.0 - 12 x 10^6	Major arterial routes.
E4	12 - 50 x 10^6	Very high volume of traffic and/or proportion of fully laden vehicles. Major arterial routes.

E2.12.4 Basic design

a) The following minimum road layers are based on an E1- traffic class (refer E2.12.3) for roads with bituminous surfaces.

Road category	Layer	Thickness (mm)	Compaction	Material
UB	Asphalt	30	95% of Marshall	AC
	Base	150	98% of MDDAD	G4
	Subbase	150	95% of MDDAD	G5
UC	Asphalt	30	95% of Marshall	AC
	Base	150	98% of MDDAD	G4
	Subbase	150	95% of MDDAD	G5
UD	Asphalt	30	95% of Marshall	AC
	Base	125	98% of MDDAD	G4
	Subbase	150	95% of MDDAD	G5

b) The following basic road layers are based on a E1- traffic class (refer E2.12.3) for roads with brick paving (or similar) surfaces.

Road category	Layer	Thickness (mm)	Compaction	Material
UB	Paving	80	-	Class 30/2.0 interlocking concrete blocks
	Sand bedding	20	-	Sand
	Base	150	95 % of MDDAD	G5
UC	Paving	80	-	Class 30/2.0 interlocking concrete blocks
	Sand bedding	20	-	Sand
	Base	125	95 % of MDDAD	G5

E3 MATERIAL SPECIFICATION

E3.1 SELECTED LAYER

At least G7-quality material compacted to 93 % of MDDAD (100% for sand)

E3.2 SUBBASE

At least G5-quality material compacted to 95 % of MDDAD.

E3.3 BASE

At least G4-quality material compacted to 98 % of MDDAD.

E3.4 PRIME

Prime shall be one of the following:

a) prime that complies with the requirements of SABS 748 or 749.
b) MC-30 or MC-70 that complies with the requirements of SABS 308.

Application rate: 0,7 l/m²

E3.5 ASPHALT SURFACING

Continuously graded as per SANS 1200 MH Table 2 Column 6.

Bituminous binder: Penetration grade bitumen, Grade 70/100.

Marshall design criteria as per SANS 1200 MH Table 6 (continuously graded).

E3.6 PAVING

General:
Paving blocks shall be Class 30/2.0, complying with SANS 1058:2012 Edition

On Roadways:
Interlocking block paving will be allowed on roads for raised pedestrian crossings, texture changes, raised intersections and for road with steep gradients (more than 12,5%) or where specifically requested to the following minimum specifications:

- 80 mm interlocking concrete blocks Class 30/2.0, complying with SANS 1058:2012 Edition 2.1
- 20 mm Bedding Sand
- Basecourse: 125 mm (UC Road category) 150 mm (UB Road category)

E3.7 KERBING AND CHANNELLING

Kerbs and channels shall be precast units bed on a 15MPa concrete layer of 50 mm minimum thickness.

Transition kerbs shall be constructed of 25 MPa concrete and shall have a steel float finish.

To prevent vehicular traffic from cutting corners and to enhance pedestrian safety, the bellmouth of all road intersections must be lined with short length barrier kerbs and channels unless otherwise agreed with the Municipality.

Dropped kerbs for pedestrians are to be provided at all intersections. Minimum 1m flat with 1m sloped sections on either side.

E3.8 SIDEWALKS

At least G5 wearing course quality gravel compacted to 93 % of MDDAD, 75mm minimum layer thickness.

OR

Premix: 30mm continuously graded asphalt premix
100mm G5 subbase compacted to 98% of MAMDD
150mm G7 selected layer compacted to 93% of MAMDD
150mm subgrade (in-situ) compacted to 90% of MAMDD

OR

Paving: 80 mm interlocking concrete blocks Class 30/2.0
20 mm Bedding Sand
75 mm G5 subbase compacted to 98% of MAMDD
150mm G7 selected layer compacted to 93% of MAMDD
150mm subgrade (in-situ) compacted to 90% of MAMDD

E3.9 DRIVEWAYS

Roads must be constructed in such a way that access to properties complies with relevant design guideline (i.e. UTG 7).

All driveways, must have an incline of minimum 2% from the edge of the kerb to the erf boundary wherafter it can be sloped to join onto the proposed driveway on the erf.

Refer to Annexure E1 for further guidelines

E3.10 ROAD SIGNS AND ROAD MARKINGS

All road traffic signs material and construction shall comply with Southern African Development Community Road Traffic Signs Manual (SADC RTSM) and South African Road Traffic Signs Manual 1997 (SARTSM)
Road signs shall have a reflective surface according to Class III of SABS 1519-1990.

Road markings shall be done with road marking paint according to SABS 731-1987.

E3.11 SPECIFICATION FOR TRENCHING

Refer to Annexure E2

E4 GENERAL PROCEDURES

E4.1 Tests

Tests for roadworks shall be as specified in the relevant clauses of SABS 1200:

Selected layer and Fill	-	1200 DM
Subbase	-	1200 ME
Base	-	1200 MF
Asphalt surfacing	-	1200 MH

ANNEXURE E1

Roads and Stormwater

Specifications for Trenching in Pedestrian Walkways, Carriageway Crossings and Roadways

Note that thrust boring is the option that is preferred to open trenching, and where practically possible, services that are required to cross the road must be carried out by trust boring.

Pedestrian Walkways

- Backfill - In situ material from trench excavation placed in 150mm thickness or sand compacted at 100% or G9 if imported.
- 100mm G5 over approved backfill.
- 25mm sand under approved pavers or 25mm continuously graded premix.

Carriageway Crossings

- Backfill - In situ material from trench excavation, min G9 placed in 150mm thickness or sand compacted at 100% or G7 if imported.
- Light duty crossing 100mm G5 over approved backfill, 25mm sand under approved pavers, or 30mm continuously graded premix
- Heavy duty crossings: 150mm G5, 25mm sand under approved pavers, or 30mm continuously graded premix
- Extra Heavy duty crossings require 200mm G2 base, placed in two layers with thicknesses of 100mm each, 25mm sand under approved pavers, or 40mm premix

Roadways

General:

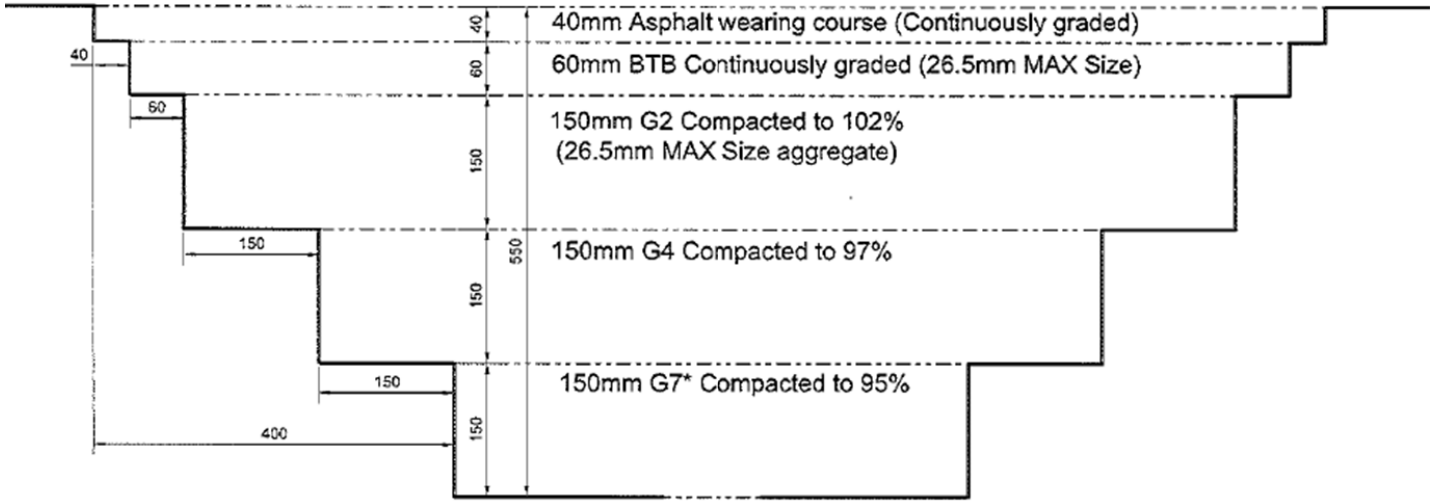
- Joints to be sealed with Via Seal and mixed in with fine sand.
- Wearing course to overlap underlying layer by 40mm on each side.
- Base course to overlap underlying layer by 150mm on each side.

Layer works for road crossings for other roads (Class 5):

- Backfill - min G9 material from trench excavation placed in 150mm thickness or sand compacted at 100%,
- 1 No. 150mm G7 Layer
- 1 No. 150mm thick G5 layer
- 1 No. 150mm thick G3 Base Course layer. G3 material with a 26.5mm maximum aggregate size, compacted to 98% Mod AASHTO maximum density
- 30mm continuously graded asphalt wearing course

Layer works for main roads and roads carrying heavy traffic (Class 3, 4 and Heavy Vehicle route):

- Backfill to be stabilized material, G9 from trench excavation (G7 if imported), placed in 150mm thickness and compacted to minimum of 93 % of modified AASHTO maximum density (or 100% compaction for sand)(backfill to be stabilized with 2% cement unless sand)
- 1 No. G7 layer 150mm thick stabilized with 2% cement
- 1 No. G4 layer 150mm thick each
- 1 No. G2 Base Course layer 150 mm thick. G2 material with a 26.5mm maximum aggregate size, compacted to 98% Mod AASHTO maximum density
- 40mm continuously graded medium asphalt wearing course



G7* material to be placed in 150mm (thickness) layers and stabilized with 2% cement

All work to be done in accordance with:
SANS 1200 Standardized specifications.

ANNEXURE E2

SITE ACCESS AND EXIT GUIDELINES

1. The following site access requirements shall apply:

   (a) Council may require compliance with standard municipal or provincial access spacing guidelines;
   (b) No access shall be closer than 10 m from an intersection as defined by the prolongation of street boundaries; except for industrial-zoned properties, where the distance shall be 15 m; and
   (c) Council may restrict or prohibit access if a pedestrian or traffic hazard is created or is likely to be created.

2. Vehicle entrances and exit ways to and from property shall conform to the following requirements:

   (a) Motor vehicle carriageway crossings shall be limited to one per site per public street or road abutting the site;
   (b) Notwithstanding subsection (a) above, where the total length of any street boundary of a site exceeds 30 m in length, one **additional** carriageway crossing may be permitted, provided that no two carriageway crossings are closer than 12 m to each other;
   (c) The minimum and maximum widths of motor vehicle carriageway crossings shall be in accordance with the following table, titled 'Width of motor vehicle carriageway crossings'.

Residential, Commercial and Light Industrial **Type of Motor Carriageway Crossing**	**Width of Dropped Kerbs**	
	Minimum	**Maximum**
Single Entrance or Exit way	**2.7 m**	**3.5 m**
Combined Entrance and Exit ways	**2.7 m**	**6.0 m**
Additional	**2.7 m**	**3.5 m**

3. On Industrial erven entrances and exit way designs to be submitted to the Transport Roads and Stormwater Department for approval.

4. Where existing accesses do not comply to these standards, new applications will not be considered.

SECTION F

DESIGN GUIDELINES AND MINIMUM STANDARDS FOR SOLID WASTE MANAGMENT

INDEX

Page

STELLENBOSCH
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Date: May 2023

Dear *Applicant*

REFUSE STORAGE AREAS: STANDARDS AND GUIDELINES TO ARCHITECTS AND BUILDING OWNERS

A single, centralised, refuse storage area which is accessible for collection from a public road is required for each complete development. The only exception is the case of a single residential dwelling, where a refuse storage area is not required or where exeptions have been motivated and approved.

1. SIZE

1.1 The refuse storage area shall be large enough to store all receptacles needed for refuse disposal on the premises, including all material intended to recycling. No waste is allowed to be disposed / stored without a proper 240 ℓ Municipal wheelie bin.

1.2 The size of the refuse storage area depends on the rate of refuse generation and the frequency of the collection service.

Where the premises might be utilised by tenants for purposes other than those originally foreseen by the building owner, the area shall be sufficiently large to store all refuse generated, no matter what the tenant's business may be. Room for future expansion is also desirable.

1.3 All black 85 ℓ refuse bins or black refuse bags have been replaced with 240 ℓ black municipal wheeled containers engraved with WC024 or Stellenbosch Municipality in front, and consequently refuse storage areas should be designed to cater for these containers. The dimensions of these containers are:

Commercial and Domestic : 585 mm wide x 730 mm deep x 1100 mm high

1.4 With regard to flats and townhouses, a minimum of 50 litres of storage capacity per person, working or living in the premises, is to be provided at a "once a week" collection frequency (i.e. 26 units at average 2 people per unit = 52 people x 50 litres per person per week = 2600 litres / 240 litres per bin = 11 bins);

1.5 With regards to commercial type of development the size of the refuse room will be determined using the following factors:

☎ 021-808 8228
🖷 021-883 9912
Directorate: Infrastructure Services
Direktoraat: Infrastruktuurdienste
epos/email:
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Whatsapp:076 951 0768

- 0,8kg waste per person per day
- Weekly or 3 times per week collection
- 240 litre wheelie bin can accommodate 9kg of waste

(i.e. Small office – 20 people in office block generates 20 x 0.8kg = 16kg per day x 5 days per working week = 80kg per weekly collection = 80/9kg per bin = 9 bins;

Big office - 200 people in office block generates 200 x 0.8kg = 160kg per day x 5 days per working week = 800kg / 3 collections per week = 267kg / 9kg per bin = 30 bins)

2. BUILDING SPECIFICATIONS

2.1 Floor

The floor shall be concrete, screened to a smooth surface and rounded to a height of 75mm around the perimeter. The floor shall be graded and drained to a floor trap (See: Water Supply and Drainage).

2.2 Walls and Roof

The Refuse Storage Area shall be roofed to prevent any rainwater from entering. The walls shall be constructed of brick, concrete or similar and painted with light colour high gloss enamel. The height of the room to the ceiling shall be not less than 2.21 metres.

2.3 Ventilation and Lighting

The refuse storage area shall be adequately lit and ventilated. The room shall be provided with a lockable door which shall be fitted with an efficient self-closing devise. The door and ventilated area shall be at least 3 metres from any door or window of a habitable room. Adequate artificial lighting is required in the storage area.

2.4 Water Supply and Drainage

A tap shall be provided in the refuse storage area for washing containers and cleaning spillage. The floor should be drained towards a 100 mm floor trap linked to a drainage pipe which discharges to a sewer gully outside the building. In some cases a grease gully may be required.

2.5 Access

Council vehicles will not enter onto private property. Refuse storage areas should be provided at the street entrance to the premises and have access to the street. In exceptional cases where this is not possible, the refuse storage area may be located

elsewhere, but not exceeding 10 metres from the street entrance to the premises, used by the Council's refuse collection employees.

Should the refuse storage area be located at a level different from the level of the street entrance to the property, access ramps are to be provided as stairs are not allowed. The maximum permissible gradient of these ramps is 1:7.

2.6 Refuse Bays on public street

A refuse bay with minimum dimensions of 15 meters in length x 2, 5 meters in width plus 45 degrees splay entrance, on a public street, must be provided where either traffic flows or traffic sight lines are affected. The refuse bays must be positioned such that the rear of the parked refuse vehicle is closest to the refuse collection area.

2.7 Compaction Equipment

Any containers or compaction equipment acquired by the building owner must be approved by the Directorate: Infrastructure Services, to ensure their compatibility with the servicing equipment and lifting attachments.

2.8 Screening and Security

Refuse should not be visible from a street or public place. Suitable screen walls may be required in certain instances.

Access must be denied to unauthorised persons, and refuse storage areas should be designed to incorporate adequate security for this purpose.

2.9 General – approval by Council

All refuse storage areas shall be approved by the Directorate: Infrastructure Services, to ensure that the Council is able to service all installations, irrespective of whether these are currently serviced by Council or other companies.

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Preshane Chandaka
Director: Infrastructure Services

SECTION G

STANDARD DETAILS

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SSW3	COVER SLAB : TYPE C
SSW4	JUNCTION BOX : TYPE 1 – PLAN (1 OF 2)
SSW5	JUNCTION BOX : TYPE 1 – SECTION (2 OF 2)
SSW6	HEADWALL : TYPE 1
SSW7	CATCHPIT : TYPE A – PLAN (1 OF 3)
SSW8	CATCHPIT : TYPE A - SECTION B-B (2 OF 3)
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