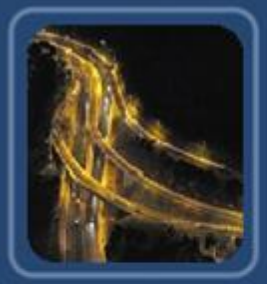
COTO STANDARD SPECIFICATIONS FOR ROAD & BRIDGE WORKS FOR SOUTH AFRICAN ROAD AUTHORITIES
OCTOBER 2020 - DRAFT STANDARD

CHAPTER 11: ANCILLARY ROAD WORKS

Presented by Kobus van der Walt

SARF

better roads



South African Road Federation

CURRICULUM VITAE

J.C. VAN DER WALT

1. Qualification: B Engineering (Civil) – University of Pretoria

2. Professional bodies: Registered as Professional Engineer with ECSA (April 1986)

3. Experience: January 1980 to March 1998

Institution: Department of Transport
Position: Started as Engineer to Chief Engineer
Duties:

- Assistant and Resident Engineer on various projects.
- Project Manager
- Pavement Design and Pavement Management Systems

4. Experience: April 1998 to March 2017

Institution: The South African National Roads Agency SOC Ltd (SANRAL)
Position: Regional Manager
Duties:

- Responsible for the management of the national road network in the Western– and Northern Cape

CURRICULUM VITAE

J.C. VAN DER WALT

5. Experience: March 2017 to December 2020

Institution: The South African National Roads Agency SOC Ltd (SANRAL)
Position: Head of the Technical Innovation Hub and Technical Excellence Academy
Duties:

- Establish a needs driven research and innovation programme.
- Implement new innovations on projects.
- Skills development of new engineering entrants.
- Monitoring of new entrants working on live projects to ensure professional registration.

6. Author (5) and co-author (6) of various papers

7. Member of the following technical committees:

- TRH15 – Subsurface drainage for roads 1994
- TMH9 – Standard Visual Assessment Manual for flexible Pavements 1992
- TRH22 – Pavement Management Systems 1994
- Draft TRH4 – Structural Design of Interurban and rural road pavements 1994/5
- TRH3 – Surfacing seals for rural and urban roads and compendium of design methods for surfacing seals used in South Africa 1995

CURRICULUM VITAE

J.C. VAN DER WALT

Member of the following technical committees: (continued)

- COLTO Standard Specifications for Road and Bridge Works 1998
- Routine Road Maintenance Guidance Manual – June 2000 (revised in 2007)
- South African Pavement Engineering Manual (SAPEM) 2013
- COTO Standard Specifications for Road and Bridge Works – Draft Standard 2020

DISCLAIMER

This presentation was prepared by the presenter , and any comments or responses are that of the presenter and not of SARF.

South Africa

COTO

Committee of Transport Officials

Standard Specifications for Road and Bridge Works for South African Road Authorities

Draft Standard (DS)

October 2020

FOREWORD

The new COTO Standard Specifications for Road and Bridge Works for South African Road Authorities was approved by COTO on 18 August 2020 as a Draft Standard (DS) and will be replacing the COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998 Edition).

Existing contracts and tenders in the design phases based on the COLTO Standard Specifications (1998 Edition) will remain unaffected but will be phased out during the next 6 months and the COTO Standard Specifications (2020 Edition) will be mandatory for use in procurement documents advertised as from 1 March 2021.

The Draft Standard will be implemented in industry for a period of two (2) years, during which written comments may be submitted to the COTO subcommittee. Draft Standards (DS) have full legal standing.

BACKGROUND

Development of SA Standard Specifications.

- **1970's: The Red Book" (used only by N-DoT/NTC and TPA ?)**
- **1987: The "Orange Book" CSRA**
- **1998: The "Green Book" COLTO**
- **2020: The "Green Book " COTO Draft Standard**

All the above were developed by a process of "evolution"?

Previous Document is some what "haphazard" in structure!!!

All the Chapters in COTO now have the same structure ☺

COTO SUITE OF DOCUMENTS

VOLUME 1	GENERAL CONDITIONS OF CONTRACT (FIDIC; GCC&NEC3)
VOLUME 2	STANDARD SPECIFICATIONS FOR:
	2.1 ROADS AND BRIDGE WORKS 2.2 ROUTINE ROAD MAINTENANCE
VOLUME 3	CONTRACT DOCUMENT
VOLUME 4	ROADWORK DRAWINGS
VOLUME 5	STRUCTURES DRAWINGS
VOLUME 6	MATERIAL UTILISATION
VOLUME 7	ENVIRONMENTAL MANAGEMENT PLAN

CONTRACT DOCUMENTATION (A1.1.2)

Contract Documentation - **includes all the documents which define the content and terms of the Contract entered into by the Employer and the Contractor**. **The Contract Documentation usually consists of the following documents:**

- Conditions of Contract.
- Contract Agreement.
- Drawings.
- Letter or Form of Tender.
- Letter or Form of Acceptance.
- Pricing Schedule.
- Project Specifications.
- Scope of the Works.
- Special (or Particular) Conditions of Contract.
- **Standard Specification (this document**) and
- Any other documents forming part of the contract.

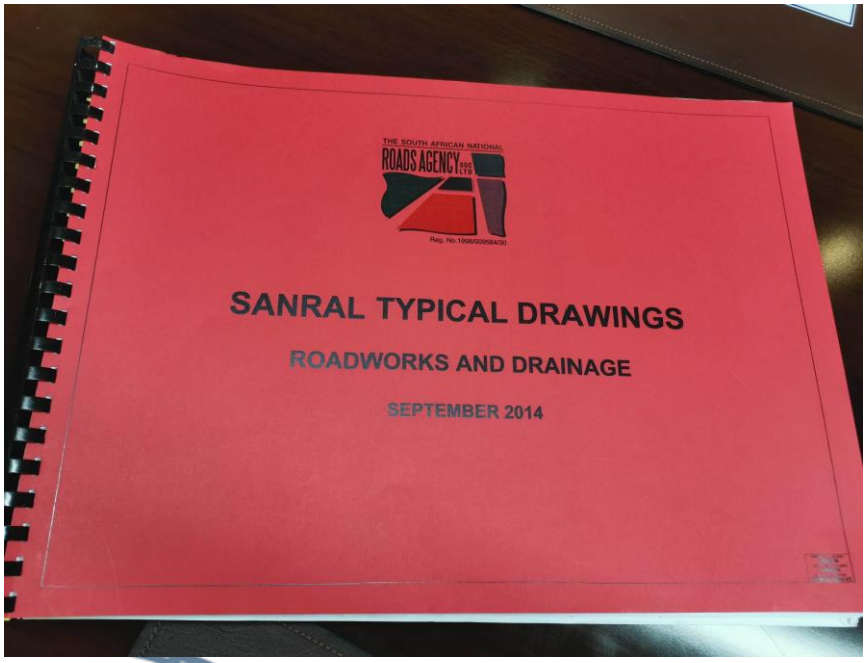
CONTRACT DOCUMENTATION

WHAT DO YOU EXPECT FROM SPECIFICATIONS??

- **No reference to proprietary products**
- **Must cover all options (road classes)**
- **Must be clear and specific (What is required)**
- **How will the quality of the end product be measured ?.**
- **How much are you willing to pay for the product ?**
- **End product must perform over its life span**

ROADWORKS & STRUCTURES DRAWINGS

- The different **Road Authorities** have their **own standard drawings** that must be complied with and needs to be **adjusted and updated to be project specific**.
- Contractors need these drawings to **price the items for tendering and construction** of the works .
- **Quality and accurate** detailed drawings are of utmost importance.
- **As built drawings** need to reflect what was constructed for future usage



COLTO STANDARD SPECIFICATIONS 1998

SERIES	TITLE	SECTIONS (55)
1000	GENERAL	7
2000	DRAINAGE	4
3000	EARTHWORKS AND PAVEMENT LAYERS OF GRAVEL OR CRUSHED STONE	9
4000	ASPHALT PAVEMENTS AND SEALS	9
5000	ANCILLARY ROADWORKS	9
6000	STRUCTURES	8
7000	SUNDRY STRUCTURES	5
8000	SUNDRIES	4

COTO DRAFT STANDARD CHAPTERS

CHAPTER	TITLE	SECTIONS (90)
1	GENERAL	7
2	SERVICES	4
3	DRAINAGE	3
4	EARTHWORKS AND PAVEMENT LAYERS: MATERIALS	5
5	EARTHWORKS AND PAVEMENT LAYERS: CONSTRUCTION	5
6	CONCRETE LAYERS	2
7	MAINTENANCE & REPAIR OF CONCRETE LAYERS	6
8	PRE-TREATMENT AND REPAIR OF CONCRETE LAYERS	9
9	ASPHALT LAYERS	1
10	SURFACE TREATMENTS	1
11	ANCILLARY ROAD WORKS	9
12	GEOTECHNICAL APPLICATIONS	12
13	STRUCTURES	14
14	REPAIR AND REHABILITATION OF STRUCTURES	11
15 TO 19	RESERVED FOR FUTURE USE	
20	QUALITY ASSURANCE	1

CHAPTERS

- **EACH CHAPTER SECTION CONSISTS OF:**

❑ PART A: SPECIFICATIONS

- *Table of Contents:*
- Scope
- Definitions
- General
- Design by Contractor/Performance Based Systems
- Materials
- Construction Equipment
- Execution of the Works
- Workmanship

❑ PART B: LABOUR ENHANCED

- 1. to 8.

❑ PART C: MEASUREMENT AND PAYMENT

❑ PART D: GUARANTEES AND COMPLIANCE CERTIFICATES

For more information on the above read Sections A1.1 GENERAL PREAMBLE and A1.2 GENERAL REQUIREMENTS AND PROVISIONS

PART A: MATERIALS

GENERAL

During the designs process one need to take note of vandalism and theft in the area that the contract will take place when considering the use of certain materials like bricks/ paving blocks / steel /iron / wood/ fencing /aluminium etc.

Need to think out of the box, be innovative and consider the use of innovative products manufacture from polymers /plastic /rubber /fibre glass etc .Have therefor included in every section for "Alternative materials ".

PART A: MATERIALS

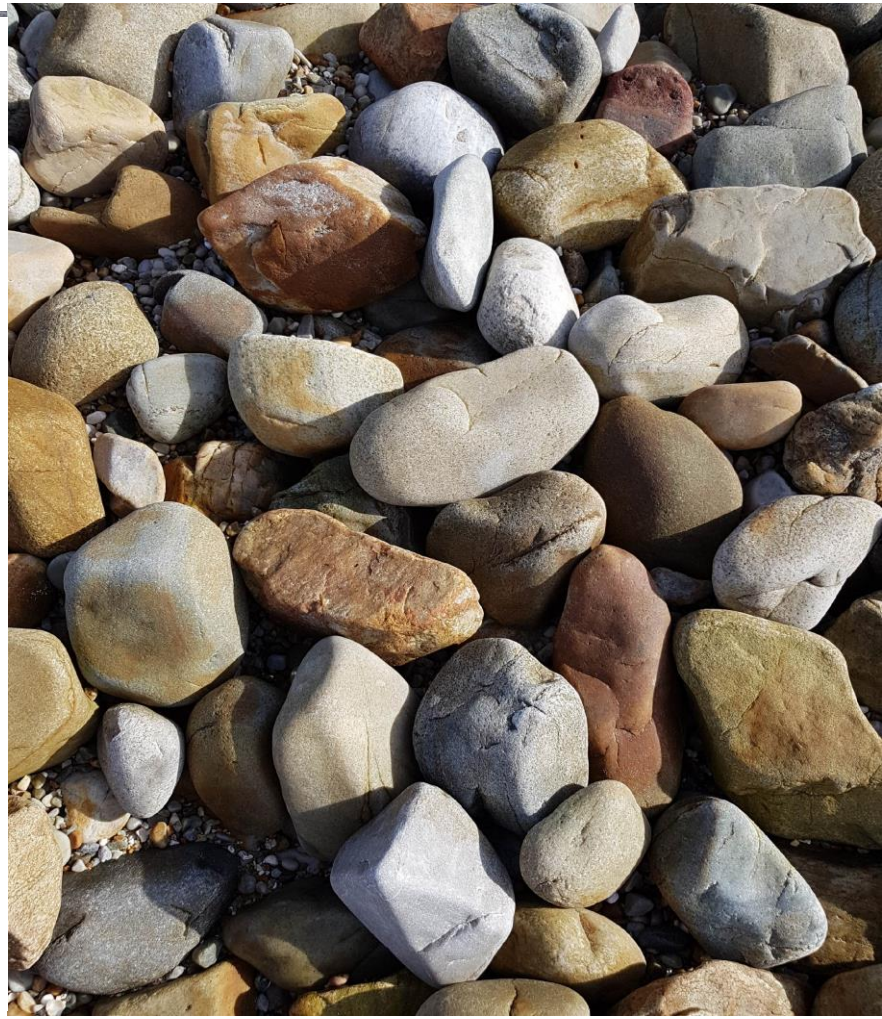
GENERAL

- The **material specifications are the required specifications** for the materials as placed and/or processed in its final position within the road reserve.
- **It is Contractor's responsibility** to ensure that the materials delivered to the road shall **meet the specified requirements**
- **Materials removed from existing works**, except where excavated materials are specified **to be reused or disposed of, or except** where provision has been made **in Part C for their reuse or specific disposal**, shall be deemed to be the **property of the Contractor. (or the Client) .See item C1.2.9: Disposal of non-useable assets**

AGGREGATE for concrete shall **comply with the requirements of SANS 1083** and for nominal size with SANS 3001 –AG1 in table A13.4.7-1.

SAND for **concrete, cement slurry and mortar** shall comply with the requirements of SANS 1083.

PART A: MATERIALS



PART A: MATERIALS

STONE :

•**Stone for pitching** shall be **sound, tough and durable**, without any stones **less than 200 mm** in dimension, except that smaller pieces or spalls may be used for filling spaces between the larger stones. **Rounded boulders shall not be used on slopes steeper than 2:1 unless cement grouted.** Unless suitable stone can be located on site, the stone for pitching shall be procured from commercial sources.

•**Stone for masonry walls** shall have a **minimum mass of 8,0 kg** for each stone, except that smaller pieces or spalls may be used . Stones shall have a **minimum vertical dimension of 75 mm** and have **a flat and stratified shape**.

•**Stone for riprap** shall be **hard or quarry stone of angular shape**. It shall be free from soft material such as sand, clay, shale or organic material and shall not contain an excessive quantity elongated stones.

The required size of the stone will depend on the "critical mass" specified (**30kg max**). At least **50 %** by mass of the material comprising the riprap shall consist of stones with a **mass heavier than the critical mass**, and **not more than 10 %** by mass of the material shall consist of stones with a mass of **less than 10 % of the critical mass** or **more than 5 times the critical mass**.

PART A: MATERIALS

CONCRETE AND MORTAR

- **All concrete work shall be carried out in accordance with the requirements of Section A13.4 of Chapter 13,** read together with the provisions of this Section. Cement shall comply with SANS 50197-1 for CEM I or CEM II with a strength class of 32.5 or greater, and a rate of strength gain of N or greater.
- Contractor shall be responsible for providing suitable materials, determining the mix proportions and manufacturing the concrete of the required quality to comply with SANS 50206.
- The **mix design shall be based upon obtaining an average concrete compressive strength sufficiently above the specified characteristic compressive strength** so that, considering the **expected variability** of the concrete and test procedures, **no more than 5 % of strength tests** will be expected to **fall below the specified characteristic compressive strength**.
- Where **concrete is supplied by a commercial** source outside the direct control of the Engineer, **the concrete supplier shall ensure compliance with the requirements of SANS 50206 (SANS 878),** and **the Contractor** shall have full responsibility **to implement acceptance control testing** in accordance with the specification.

PART A: MATERIALS

CONCRETE AND MORTAR (CONTINUE)

- Unless otherwise specified, **mortar** shall consist of a **mixture of six parts of concrete sand to one part of cement**.
- **Concrete and mortar** shall be properly mixed to a uniform consistency. The total period between the **time that the cement is placed into the mix until mixing starts shall not exceed 15 minutes.**
- **Concrete and mortar** shall be so **transported** to its final position that **segregation** or loss of any of the ingredients or contamination **will be prevented** and that the mix is of the required workability at the point and time of placing. **No additional water may be added in transit or were delivered or placed.**
- Once the **casting of concrete** has begun, it shall be carried out **in a continuous process between construction joints**. Concrete shall be **placed within 60 minutes from the start of mixing**. This **time may be extended** by the Engineer **where a retarding admixture has been used**. All excavations and other contact surfaces of an absorbent nature shall be damp, but no standing water shall be permitted to remain on these surfaces.

PART A: MATERIALS

CONCRETE (CLASS C) STRENGTH

The compressive strength class is indicated by the designated concrete code C, the characteristic 28-day cylinder strength in MPa, the characteristic 28-day cube compressive strength in MPa and the nominal size of coarse aggregate in the mix. For example, C20/25-20 means strength concrete class with a **characteristic cylinder strength of 20 MPa at 28 days** or **characteristic cube compressive strength of 25 MPa** at 28 days and a **nominal size coarse aggregate of 20 mm.**

PORTLAND CEMENT TYPES (CEM1TO 5)

CEM1 42,5N would be expected to achieve at least **42,5 MPa at 28 days using the specified mortar prism test .**

While **real concrete** made from the cement will achieve **42,5 MPa in concrete cube tests depend on a range of other factors** like **concrete porosity, water /cement ratio, soundness of aggregate ,aggregate bonding and cement related parameters** (alite content, alite and belite reactivity, cement sulfate content)**.**

PART A: MATERIALS

Geotextiles are planar soil and polymeric (synthetic or natural) textile material which may be nonwoven, knitted, woven knitted or stitch-bonded fibres or yarns. Its selection is based on:

- **Permeability reduction(clogging)**
- **Piping (retention criteria)**
- **Permeability**
- **Strength (construction survivability)**
- **Durability criteria**

During the design phase soil sampling and testing based on sound statistical principles must be undertaken on site, to simulate long term field conditions in the laboratory. The specified tests are stated in Chapter 20, Clause A20.14.13.

PART A: MATERIALS

Geotextiles are covered in Chapter 12 Section A12.11 under Geosynthetics. The section does not contain any **measurement and payment items which should be covered in the chapter/section of use.**

What is the minimum geotextile recommendation grade ??

This should be determined in the design phase and specified in the contract documentation.

Not to favour any suppliers the minimum recommendation properties for geotextiles similar to table 2104 in COLTO are not specified. (permeability criteria)

PART A: EXECUTION OF THE WORKS

CLASSIFICATION OF MATERIAL

All excavations shall be classified as follows for payment purposes:

Hard material:

- Material which **cannot be excavated except by drilling and blasting**, or with the use of pneumatic tools or mechanical breakers.
- **Boulders exceeding 0,1 m^3**; where more than **40 %** by volume of any material consists of boulders, each exceeding 0,1 m^3 in size, the material shall be classified as hard material.

Soft material: **All material not classified as hard material** shall be classified as soft material

NO MORE INTERMEDIATE CLASSIFICATION !!

WORKMANSHIP/ QUALITY ASSURANCE

Quality

- Difference between products
- Type of product
- Distinctive feature
- "Fit for purpose"

Assurance

- Measurement
- Inspections
- Apply appropriate products
- Guarantee

End product

- Structural
- Functional
- Durability

For whom?

- Asset of the Country
- Betterment of Civil Society to be valued and enjoyed

PART A: WORKMANSHIP

- The **Contractor shall determine the required frequency of testing and conduct sufficient tests** on the sourced material for each type of material **in order to ensure that the quality of materials produced will meet the specified requirements for which it will be used.**
- The **Engineer may, at his discretion, decide to use the Contractor's test results** if he is satisfied that the Contractor has complied with the process control requirements **as acceptance control.**
- **Any work or materials which do not comply with the specified requirements, shall be removed and replaced with work or materials which comply with the requirements or, if the Engineer so permits, shall be repaired so that it shall comply with the specified requirements after having been repaired**.

PART A: WORKMANSHIP

A20.1 TESTING MATERIALS AND JUDGEMENT OF WORKMANSHIP

SCOPE

- **During the execution of the work, control testing shall be conducted on materials and workmanship to monitor compliance with the requirements of the specifications**. **Tests, measurements, and inspections** shall be carried out using manual, mechanical and electronic equipment on materials and workmanship before, during and after construction **to ensure compliance** with the quality requirements of the specifications.
- **Chapter 20 also describes the schemes that are specified to ascertain compliance with the specification of certain materials properties and workmanship**. This is achieved by means of tests and measurements, and, where applicable, by applying statistical judgement plans.
- **The statistical acceptance control requirements, unless otherwise specified, apply to Class A, B, C and D roads, as classified in TRH 26 South African Road Classification & Access Management Manual**. The acceptance control requirements for lower classes of roads shall be specified in the Contract Documentation.

PART B: LABOUR ENHANCED

Definition: Labour Enhanced means to improve the scope for labour

The methods and specifications related to labour enhanced construction are contained in **Part B** of each of the relevant sections of these Standard Specifications. **The requirement for the use of labour enhanced construction methods to satisfy any particular project goals should be set out in the contract documentation. (decided/considered in design stage already)**

The **Specifications given in Part A will apply to all work carried by using labour** enhanced construction methods unless some of **the Specifications in Part A are replaced with revised Specifications in Part B that are specifically applicable to the specified labour enhanced construction or additional Specification for labour enhanced construction are provided in Part B.**

PART B: LABOUR ENHANCED

ADVANTAGES

- **All projects have components of labour.**
- The **Specifications are applicable to both machine and labour work**.
- **Emerging contractors are exposed to the entire document**, although small part may be applicable.
- The **Specifications combined with the payment items** were compiled **to be able to enhance the labour component.**

PART B: LABOUR ENHANCED

PAYMENT ITEMS

- **Part C contains the payment items for both the conventional and labour enhanced options.**

- **A special payment item is provided to allow for the disclosure of the labour content for the full duration of the project in order to satisfy the project goals.**

- **Where the excavation of material is specified by means of labour enhanced construction methods, the tendered rates shall include loading and transport by wheelbarrow if the material is disposed of or utilised within a radius of 50 m, alternatively loading by hand onto transport vehicles for such disposal or utilisation elsewhere, within a haul distance of 1,0 km.**

PART B: LABOUR ENHANCED

CONCRETE MIXING BY HAND

- **Concrete may be mixed by hand or in hand-turned concrete mixers for small pours up to one (1) cubic metre**. Larger pours greater than one cubic metre shall be machine mixed with on-site mechanical mixers and/or batch plants.
- The **mix design shall be based upon obtaining an average concrete compressive strength sufficiently above the specified characteristic compressive strength so that, considering the expected variability of the concrete and test procedures, no more than 5 % of strength tests will be expected to fall below the specified characteristic compressive strength**.
- **All concrete mixed on the site of works shall be weigh-batched unless the Contractor can demonstrate to the Engineer that his method of proportioning the concrete ingredients consistently produces uniform concrete, which meets the strength requirements.**

PART B: LABOUR ENHANCED

CLASSIFICATION OF EXCAVATED MATERIALS

Table B11.1.7-1: Classification of Excavated Materials

Materials Classification	Description
Soft	Material which can be excavated by means of a suitable shovel with or without the use of a pick or other hand-swung tool.
Intermediate	Material which is difficult to excavate by hand even with the aid of a crowbar and requires the assistance of pneumatic tools for economic removal.

Table B11.1.7-2: Classification of Materials in Terms of Consistency and Shear Strength

Materials Classification	Consistency		Number of DCP blows to penetrate 100 mm *1	
	Granular soil	Cohesive soil	Granular soil	Cohesive soil *2
Soft	Very loose to dense	Very soft to stiff	≤ 15	≤ 8
Intermediate	Very dense	Very stiff	>15	>8

*1 Only applicable to materials comprising not more than 10 % gravel of size less than 10 mm and materials containing no cobbles or isolated small boulders.

*2 Classification depends on the moisture content of the cohesive material.

PART C: MEASUREMENT & PAYMENT

ALL MEASUREMENT & PAYMENT SECTIONS IN THE VARIOUS CHAPTERS CONSIST OF THE FOLLOWING:

- Preamble
- Items that will **not be measured separately**
- Items to be measured and paid for using payment **items specified else where in the Specification**
- Payment **items specified for the Section**

PART C: MEASUREMENT & PAYMENT

CONTRACT RATES

In computing the final contract amount, payment shall be based on the actual quantity of authorized work done in accordance with the specifications, instructions and drawings. The contract rates shall apply, subject to the provisions of the Contract Documentation, irrespective of whether the actual quantities are more or less than the scheduled quantities

Where NO rate or price has been entered against a pay item in the Pricing Schedule by a Contractor, it shall be accepted that NO compensation for such work is required or will be paid regardless of the final measured quantity.

The contract rate for each item shall include full compensation for providing, maintaining and decommissioning upon completion, of all the plant, equipment, labour, tools, incidentals and supervision to carry out the activity or construct the Works in the item, unless otherwise stated.

Any prime cost or provisional sums shall be paid in accordance with the provisions of the Conditions of Contract.

PART C: MEASUREMENT & PAYMENT

PAYMENT ITEMS FROM DIFFERENT SECTIONS

Whenever a payment item that is specified in a particular Section is required to be used in another section of the Pricing Schedule then the relevant payment item number will be preceded by a reference to the Section in which it is being used.

For example, the loading and hauling payment items from Section C1.7 may be inserted into the Pricing Schedule for the loading and hauling of the material required for the pavement layers which are paid for under the payment Section C5.3 as follows:

C5.3/1.7.1.1 Loading from stockpile cubic metres (m^3)

C5.3/1.7.2.1 Hauling material for use in the Works and off-loading it on the site of the Works cubic metre kilometres (m^3-km)

PART C: MEASUREMENT & PAYMENT

PAYMENT ITEMS FROM DIFFERENT SECTIONS

Examples :

- **C11.(sections)/ 1.2.9 Disposal of non-useable assets**
- **C11.(sections)/1.6 Clear and grubbing designated excavation areas/fence lines and other ancillary areas**
- **C11.(sections)/1.7.1 Loading –no payment for loading**
- **C11.(sections)/1.7.2 Hauling**
- **C11.4/13.8.1 Concrete barriers**
- **C11.5/1.6.3 Removal of trees**
- **C11.6/13.4.1,13.3.1,13.2.1 Gantry footings**
- **C11.8 /1.6.8 Replanting of shrubs and trees from site nursery**
- **C11.8/1.6.9 Stockpiling of topsoil**

PART C: MEASUREMENT & PAYMENT

C1.7 LOADING AND HAULING

Loading is the operation of picking material from an excavation or stockpile and placing it in a haul vehicle.

Payment item C1.7.1: Loading – only payment if it is from stockpiles, heaps or windrows.

Hauling is the moving of loaded construction material from point of excavation or from a stockpile to the point of use or designated spoil area (including –offloading).

Payment item C1.7.2 Hauling – 70 % of loaded haul vehicle volume for soil and gravel and 50 % for hard material or boulders.

Note that for Sections C11.1 to C11.9. No separate payment will be made for the loading of any material or hauling of material over a distance of less than and up to 1,0 km. Payment for these items to be include in tender rates.

PART C: MEASUREMENT & PAYMENT

PRACTICAL ADVICE

- **Ensure that supervision team has files on site which reflect the calculation of the design quantities.**
- **Supervision team must do independent calculations of quantities for payment purposes and not rely on that of the contractor.**
- **Payment quantities must be signed off with the contractor on monthly basis.**
- **Supervision team must monitor the contractors working program to be able to provide accurate cash flow for payment purposes.**
- **Supervision team needs to do at least two remeasurements of the expected final contract amount (over and under expenditure).**
- **Supervision team needs to carry out daily site inspections to monitor the works.**

PART C: MEASUREMENT & PAYMENT

PRACTICAL ADVICE

- **Where no specific payment items exist in the Part C Measurement and payment , the work can still be undertaken through negotiations between the Client /Engineer/Contractor on a basis of**

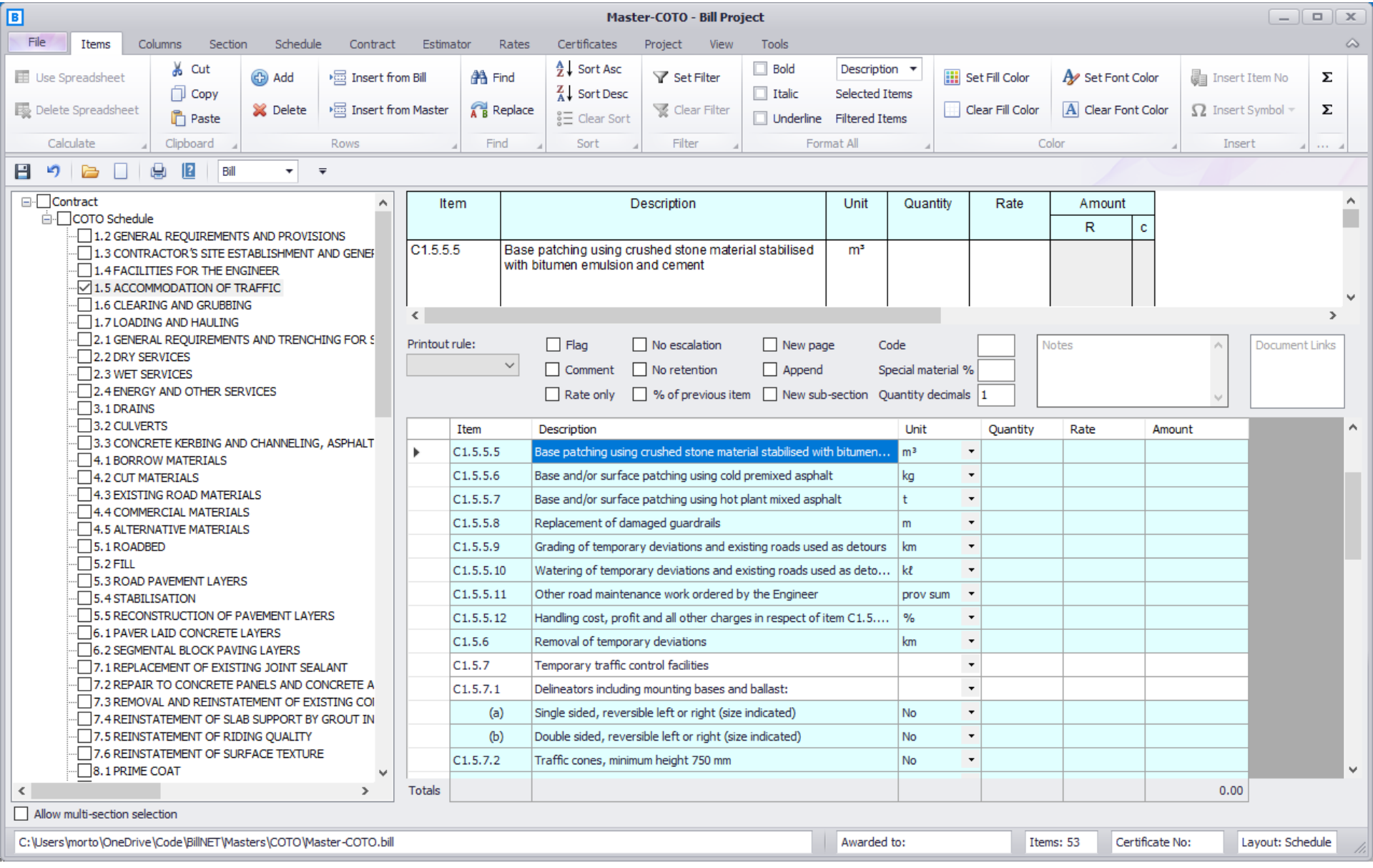
  1) Dayworks (item C1.2.6) or

  2) Variation Orders /Work Authorisation (WA)

- **How does the Contractor price in advance on an item which is " as determined /instructed by the Engineer " ? Rather specify the item clearly in the Contract document or in the drawings .**

- **The use of drones to measure quantities – borrow pits / stockpiles /cuts /fills /clear and grub/finishing the road reserve etc. How effective when its small measurements ???**

PART C: MEASUREMENT & PAYMENT



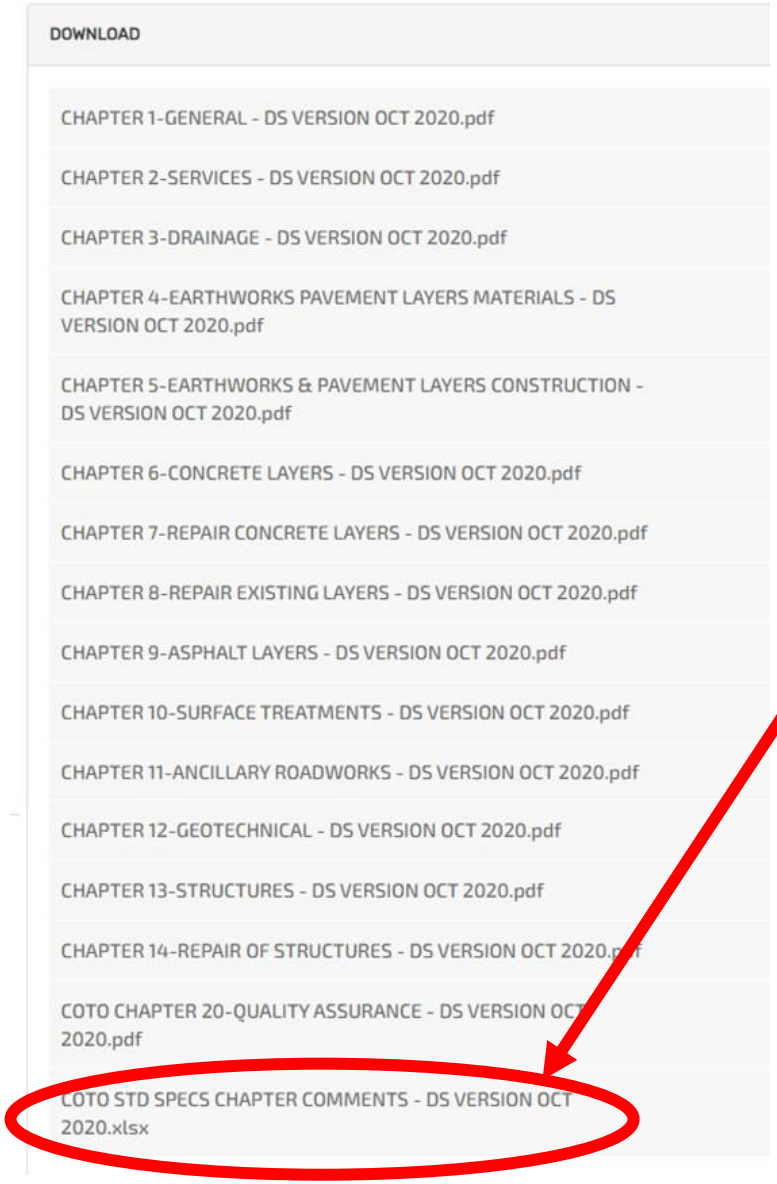
PART D: GUARANTEES AND COMPLIANCE CERTIFICATES

The requirements for any performance guarantees and/or compliance certificates are specified in Part D of each chapter where applicable.

All product quality / performance / safety certificates issued by the South African Bureau of Standards (SABS) and by Agrément South Africa (ASA) will be accepted. (Agrement certification/specification is used where no SANS certification/specification exist)

Product quality / performance / safety certificates issued by testing authorities based in foreign countries will only be accepted if specified in the Contract Documentation or at the discretion of the Employer.

COMMENTS ON COTO CHAPTERS



Written comments are to be completed on the Excel spreadsheet format provided with the Draft Standard documents on the SANRAL website and emailed to cotorevision@nra.co.za

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COMMENTS ON COTO CHAPTERS

Example of spreadsheet for COTO comments

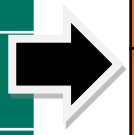
COTO Chapter	Comment number (name/surname initials followed by number eg for John Smith would be JS1, JS2, etc.	Your name	Your Road Authority /Institution/ Company	Page	PART A, B, C or D Section/Clause	Type of comment: General comment – GC Editorial comment – EC Technical comment - TC	Comments : justification for change	Proposed change	Observations of the COTO subcommittee on each comment submitted

Written comments to be emailed to
cotorevision@nra.co.za

QUESTIONS

CHAPTER 11: ANCILLARY ROAD WORKS

5000	ANCILLARY ROAD WORKS
5100	PITCHING, STONEWORK AND PROTECTION AGAINST EROSION
5200	GABIONS
5300	GUIDE BLOCKS
5400	GUARDRAILS
5500	FENCING
5600	ROAD SIGNS
5700	ROAD MARKINGS
5800	LANDSCAPING AND PLANTING PLANTS
5900	FINISHING THE ROAD RESERVE AND TREATING OLD ROADS



SECTION	DESCRIPTION
A11.1	PITCHING, STONEWORK ,CAST IN SITU CONCRETE FOR PROTECTION AGAINST EROSION
A11.2	NON-STRUCTURAL GABIONS
A11.3	GUIDE BLOCKS AND KILOMETRE MARKERS
A11.4	ROAD RESTRAINT SYSTEMS
A11.5	FENCING
A11.6	ROAD SIGNS
A11.7	ROAD MARKINGS
A11.8	LANDSCAPING AND PLANTING PLANTS
A11.9	FINISHING THE ROAD AND ROAD RESERVE AND TREATING OLD ROADS

11.1 PITCHING, STONEWORK, CAST IN SITU CONCRETE FOR PROTECTION AGAINST EROSION

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CONTENTS

11.1 PITCHING, STONEWORK, CAST IN SITU CONCRETE FOR PROTECTION AGAINST EROSION

A11.1.1 SCOPE

This Section covers the furnishing of materials and the construction of **protective coverings using stone, cast in situ concrete, bricks, prefabricated concrete elements, wire or alternative materials on exposed surfaces such as earth slopes, drains and stream beds, as well as heavier protective layers in the form of riprap and the construction of stone masonry for walls**, as specified and shown on the drawings, or as specified in the Contract Documentation.

A11.1.5: MATERIALS

A11.1.5.1 STONE

A11.1.5.2 SAND

A11.1.5.3 GRASS BLOCKS

Concrete grass blocks shall consist of concrete slabs of the dimensions and strength class shown on the drawings, **with openings through the slab totalling at least 20 % of the surface area.**

A11.1.5.4 CONCRETE AND MORTAR

A11.1.5.5 PERMEABLE MATERIAL FOR FILTER LAYER

A11.1.5.6 GEOTEXTILES

A11.1.5.7 ALTERNATIVE MATERIALS

Their property requirements, construction, measurement and payment as specified in The Contract Documentation.

A11.1.7: EXECUTION OF THE WORK

A11.1.7.2 Stone Pitching

a) Plain Stone Pitching

The area shall be prepared by the excavating, shaping and trimming necessary for pitching, and by thoroughly compacting the area by hand-ramming to prevent subsequent settlement. A trench shall be excavated as specified along the toe of any slopes to be pitched or along the unprotected edge of the pitching in the beds of streams. All loose material shall be **compacted to a density of not less than 93 % of MDD**. Where the in situ material is unsuitable, the Engineer may instruct that it be removed to the required depth and replaced with selected material compacted to a density of 93 % of MDD .

Method 1

Commencing at the bottom of the trench, the stone shall be laid and firmly bedded into the slope and against adjoining stones. The stones shall be well rammed into the bank or surface to be protected and the spaces between the larger stones shall be filled with spalls of approved pitching stone securely rammed into place.

Method 2

The technique and requirements laid down in **Method 1 shall also apply to Method 2, except in the following aspects:**

- **No small stones or spalls shall be used to fill in spaces between larger stones.**
- **Simultaneously with the placing of stones, topsoil shall be introduced between individual stones, and sufficiently rammed so as to provide a firm bonded structure. The topsoil shall be provided to the full depth of the stone pitching at any point**
- **Rooted grass or tufts of grass shall then be planted in the topsoil between stones and watered immediately and copiously and thereafter at regular Intervals until grass has been established.**

A11.1.7: EXECUTION OF THE WORK

A11.1.7.2 STONE PITCHING

b) Grouted stone pitching with mortar

The stones shall be thoroughly cleaned of adhering dirt or clay. **Commencing from the bottom of the trench, the stone shall be moistened and embedded in freshly laid cement mortar composed of one part of cement to every six parts of sand by volume**. The stones shall be firmly bedded against adjoining stones. The stones shall be laid with their longitudinal axes at right angles to the slope and with staggered joints. Any **spaces between the stones shall be filled with cement grout of the same composition as the mortar.** The mortar and grout shall be placed in a continuous operation for any day's run at any one location. The grout shall be worked into the pitching so as to ensure that all spaces or **voids between the stones will be completely filled with grout to the depth**.

c) Grouted stone pitching on concrete bed

The **area to be pitched shall be prepared as described above and a concrete bed (class C16/20-20 concrete) with a thickness of at least 75 mm** shall then be placed. The **stone pitching shall be laid while the concrete is still workable. Openings between stones shall be filled with cement grout** and stone protrusion constructed as described in above and care shall be taken not to spill the grout onto the finally exposed surfaces of the stones.

A11.1.7: EXECUTION OF THE WORK

A11.1.7.3 RIPRAP consist of **a course or courses of large rock placed on bank slopes and toes in stream and riverbeds where protection is required**. There are two types:

- **Packed riprap** shall be **constructed with rocks placed individually** to stagger the joints and firmly bedded in the prepared surface. **The spaces between larger stones shall be filled with spalls or smaller stones** securely rammed into place. On inclined surfaces the rock shall be laid in long horizontal strips starting from the bottom, and not in strips up the slope.
- **Dumped riprap** shall be **constructed by dumping the stone on the prepared surface, spreading it by bulldozer, or other suitable earth-moving equipment**, and trimming it to the required lines and levels. The material shall be placed in a manner that will prevent the segregation of the smaller and larger stones and the top layer shall be tight with a minimum of voids.

Filter Bed consist of **a layer or layers of permeable material placed on prepared surfaces to the required thickness** .When the use of geotextile is required ,the **geotextile shall be placed on the prepared surface or the filter bed .**

A11.1.7: EXECUTION OF THE WORK

A11.1.7.4 Stone masonry walls

b) Plain packed stone walls

A **foundation trench shall be excavated** down to rock, or to material with an adequate bearing capacity at a minimum depth of 300 mm below ground level or as indicated on the drawings. **Large selected stones shall be used for the foundation layer. Thereafter flat and stratified stones shall be laid with the largest dimension in the horizontal plane.** Stones shall **be packed individually to stagger the joints and to provide a minimum of voids**, and shall be firmly bedded against adjoining stones. The spaces between the larger stones shall be filled with spalls securely rammed into place. The larger stones shall not bear on the spalls used for filling the voids. The top and ends of the wall shall be neatly finished with selected coping stones.

c) Cement-mortared stone walls

The **foundation and walling shall be constructed as specified for plain packed walls as above, with the exception that the stones, including the foundation layer, shall be wetted and set in a mortar bed**. The exposed parts of the stones on the wall faces shall be cleaned of all mortar by washing or wire-brushing.

A11.1.7: EXECUTION OF THE WORK

A11.1.7.5 Concrete Pitching

b) Edge beams

Concrete edge beams or any such other edge supports shall be constructed onto the supporting layer in accordance with the details shown on the drawings and shall be constructed and left to cure before any paving blocks are laid.

c) Concrete grass blocks

Concrete grass blocks of the size specified or shown on the drawings shall be placed on areas prepared for grassing as specified in Section A11.8. The **holes in the blocks shall be filled with topsoil, and grassed with grass cuttings or hydroseeding** as specified in Section A11.8.

A11.1.7: EXECUTION OF THE WORK

A11.1.7.6 Cast in situ concrete pitching

The **areas where cast in situ concrete pitching is to be constructed shall be compacted and trimmed**. The areas shall also be treated with vegetation destroyer and ant poison if required.

Prior to placing the concrete, the surface shall be watered and kept damp until the concrete has been placed. Where specified, steel reinforcing of the type specified shall be placed at the required location and depth. Unless otherwise specified, **class C20/25-20 concrete shall be used**, and the concrete shall be accurately laid in alternate panels to the lines and levels indicated, after which the remaining panels shall be similarly placed. The concrete shall be thoroughly compacted and finished to a class U2 surface finish.

The **concrete pitching shall be cured for at least seven days and no traffic shall be allowed to move across the surface before the specified 28-day strength has been reached.**

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QUESTIONS

11.2 NON-STRUCTURAL GABIONS

11.2 NON-STRUCTURAL GABIONS

11.2 NON-STRUCTURAL GABIONS

CONTENTS

11.2 NON-STRUCTURAL GABIONS

A11.2.1 SCOPE

This Section covers the **construction of non-structural gabion boxes and mattresses for constructing lining channels, revetments and other anti-erosion and containment structures.**

For structural gabion work refer to Section A12.6 of Chapter 12.

A11.2.5: MATERIALS

A11.2.5.2 a) ROCK/STONE

A11.2.5.2 b) WIRE

A11.2.5.2 c) PVC-COATED WIRE

A11.2,5.2 d) GALVANIZING

A11.2.5.2 e) WIRE MESH

A11.2.5.2 f) GEOTEXTILES (below or behind gabions)

All above materials in Clause A12.6.5.2 Chapter 12.

A11.2.5.2 g) ALTERNATIVE MATERIALS

Their property requirements, construction, measurement and payment as specified in Contract Documentation

A11.2.5: MATERIALS

Proposed addition :

A11.2.5.2 h) POLYMER FILM SHEETING as specified in A3.1.5.2d)

A11.2.7 EXECUTIONOF THE WORKS

A11.2.7.2 CONSTRUCTING GABION BOXES AND MATTRESSES

- **Gabion boxes shall be manufactured from steel wire coated with zinc, zinc aluminum alloy double twisted wire mesh of the size and type and selvedge as specified in Section A12.6 of Chapter 12**. The boxes will be of two types and shall be subdivided into cells by wire mesh diaphragms.
- **Mattresses** which are **generally used as single-layer aprons in revetments, channel linings, etc., which the maximum width of units shall be 2,0 m, and the maximum depth 0,3 m.** Mattresses shall be subdivided by diaphragms into cells with a width of 1000 mm. Mattress shall be installed with diaphragm spaced at 1,0 m in the direction of the flow.
- **The binding wire (lacings)** shall have the **same properties as the gabion or mattress mesh wire**.
- Where required, a foundation trench along the toe of the revetment or wall shall be excavated to the dimensions specified and/or shown on the drawings.
- The **methods of constructing, stretching, placing in position, wiring and filling the gabions with rock shall generally be in accordance with the manufacturer's instructions.**
- It is **essential that the corners of gabion boxes be securely wired** together to provide a uniform surface and ensure that the structure does not resemble a series of blocks or panels.

A11.2.7 EXECUTION OF THE WORKS

A11.2.7.2 CONSTRUCTING GABION BOXES AND MATTRESSES

h) Rock filling

(i) <u>Boxes in gabions</u>

Particular care shall be taken in packing the visible faces of gabion boxes, where only selected stone of the specified size(100 to 200mm) shall be used to obtain an even-faced finish. The boxes shall be filled in layers to prevent deformation and bulging. **Boxes shall be wire braced and filled to just below the level of the internal wire braces,** after which the braces shall be twisted to provide tension. Care must be taken to ensure that consecutive layers of boxes are filled evenly to a level surface ready to receive the next course.

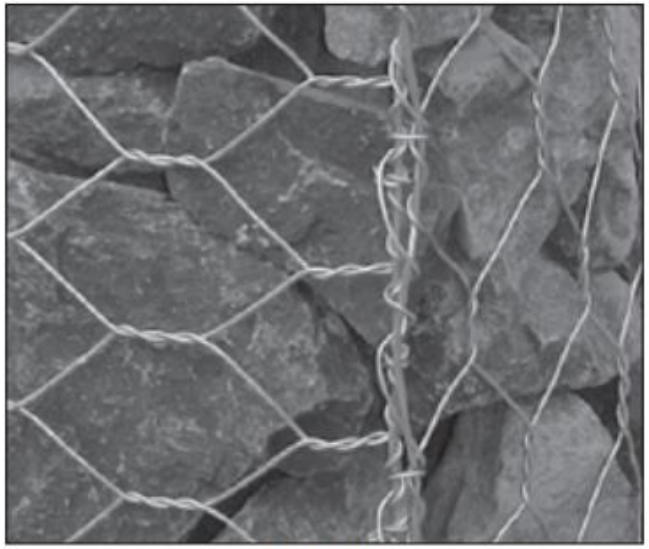
Filling of gabion boxes by dumping rock shall not be permitted and packing shall be done by means of hand labour.

(i) <u>Mattresses used in revetments and aprons</u>

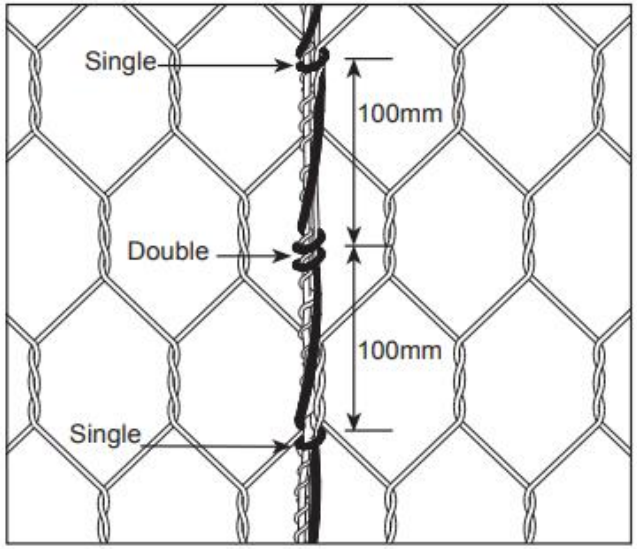
The 0,17 m, 0,23 m and 0,3 m mattresses forming aprons and revetments shall be filled by random stones being packed in the first layer and by selected stones being used for the top layer to resemble normal stone pitching.

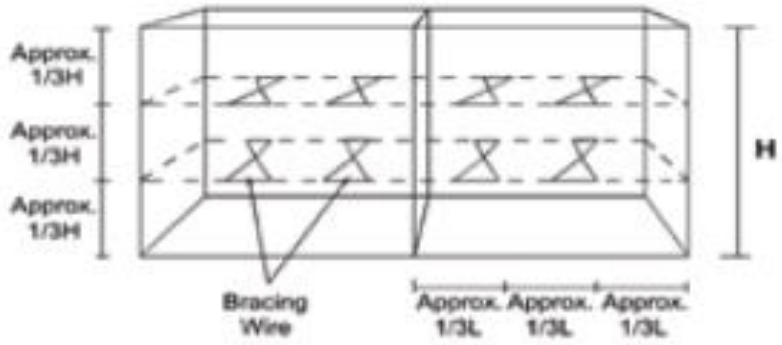
A11.2.7 EXECUTION OF THE WORKS

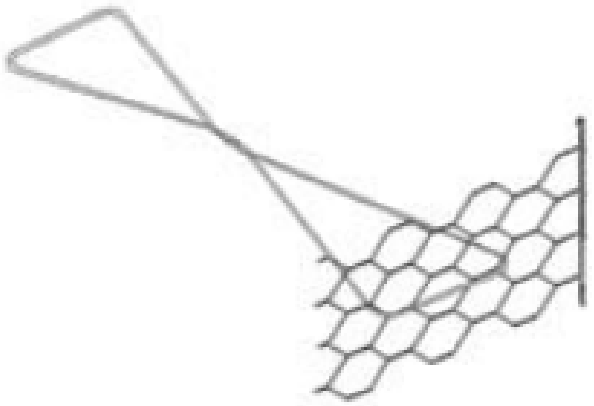
A11.2.7.2 CONSTRUCTING GABION BOXES AND MATTRESSES



LACING







QUESTIONS

11.3 GUIDE BLOCKS AND KILOMETRE MARKERS

11.3 GUIDE BLOCKS AND KILOMETRE MARKERS

11.3 GUIDE BLOCKS AND KILOMETRE MARKERS

CONTENTS

11.3 GUIDE BLOCKS AND KILOMETRE MARKERS

A11.3.1 SCOPE

This Section **covers the manufacturing, supply and erection of guide blocks and markers, mainly constructed of precast concrete**, in positions and in accordance with the dimensions specified and/or shown on the drawings.

•**Guide blocks** are located on the outer extremities of particularly narrow width roads to assist and guide road users in **demarcating the road edge**.

• **Kilometre markers** are located at full or partial kilometre positions to **demarcate the distance and route numbering**.

•.**Other precast elements may also be included under this Section, as specified under the Contract Documentation**.

•**Guiding demarcations or kilometre posts not of concrete construction shall be specified and included under Section A11.6**

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11.3 GUIDE BLOCKS AND KILOMETRE MARKERS

A11.3.1 SCOPE

- **Guiding demarcations or kilometre posts not of concrete** construction shall be specified and included under **Section A11.6**.

A11.3.5: MATERIALS

A11.3.5.2 CONCRETE

A11.3.5.3 SAND AND GRIT

A11.3.5.4 PAINT for **guide blocks shall be non-reflectorised road marking paint as specified in Section A11.7.** Paint for the **recess in the block shall be retro-reflective solvent or water-based paint as specified in Section A11.7**. Unless otherwise specified, paint for the block shall be of white colour.

A11.3.5.5 ALTERNATIVE MATERIALS

Their property requirements, construction, measurement and payment as specified in the Contract Documentation

A11.3.7 EXECUTION OF THE WORKS

A11.3.7.2 FABRICATING

Precast units shall be fabricated to the dimensions specified and/or shown on the drawings. The concrete mixture shall be placed in the forms and vibrated on a vibrating table or by other approved means. **The units shall be reinforced as shown on the drawings and shall have an F3 surface finish.**

A11.3.7.3 SPACING THE GUIDE BLOCKS AND KILOMETRE MARKERS

Shall be **spaced and located as specified and/or shown on the drawings.(every 200m or 1000m)**

A11.3.7.4 ERECTING

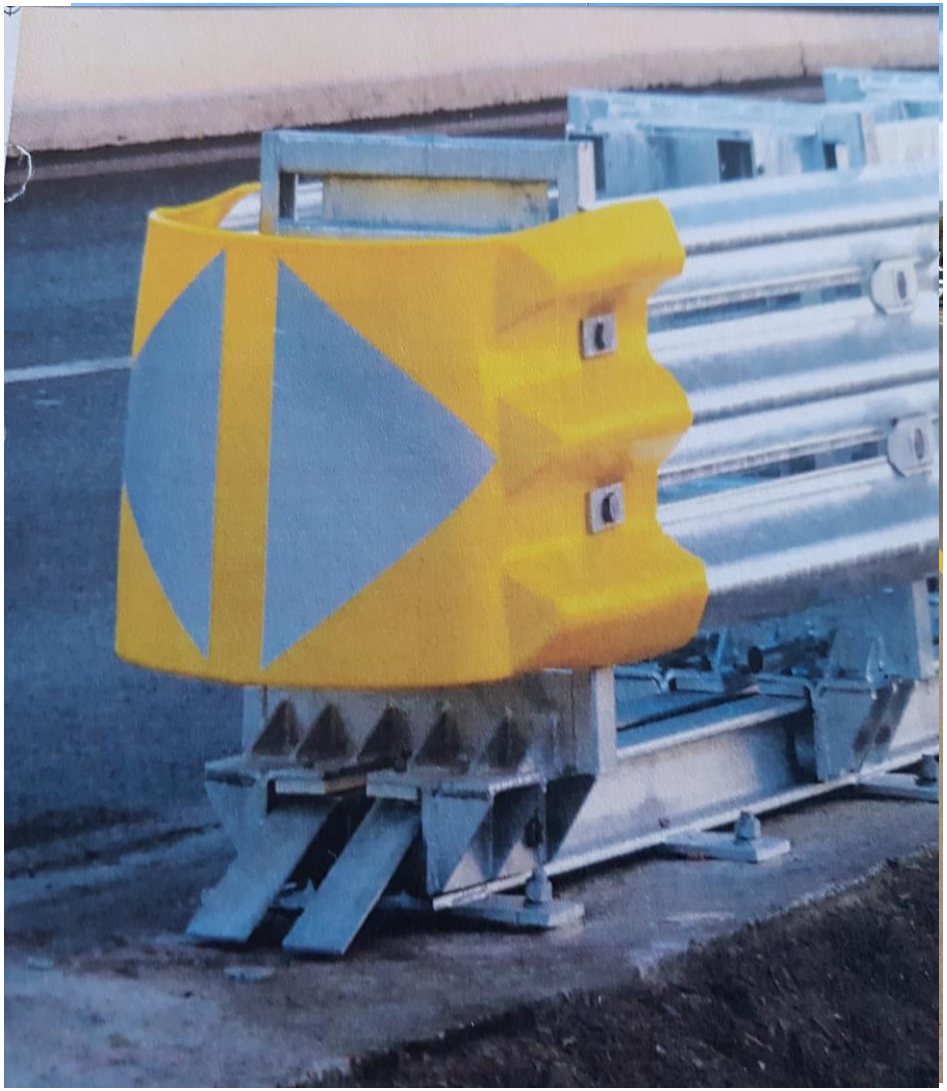
Kilometer markers and guide blocks shall be erected after the surfacing and completion of all machine trimming at the positions indicated on the drawings or as specified by the Engineer.

Backfilling shall be compacted in layers not exceeding 100 mm from the bottom of the hole. Surplus excavated material shall be disposed of by the Contractor at no additional payment**. The units shall be painted prior to installation.**

QUESTIONS

11.4 ROAD RESTRAINT SYSTEMS

11.4 ROAD RESTRAINT SYSTEMS

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11.4 ROAD RESTRAINT SYSTEMS

CONTENTS

11.4 ROAD RESTRAINT SYSTEMS

A11.4.1 SCOPE

This Section **covers the supplying, installing and maintaining of various types of Road Restraint Systems (RRS) at locations and in accordance with the specifications** and details, dimensions and design **shown on the drawings**; or **specified by the Engineer; or as specified by the performance-based system manufacturer.** There are **two types of Road Restraint Systems, namely Vehicle Restraint Systems (VRS) and Pedestrian Restraint Systems (PRS),** these systems may either be rigid, semi rigid or flexible, with transitions between the different types.

Vehicle Restraint Systems shall be divided into systems based either on:

1. **Method specification** timber post systems with elements conforming to SANS 1350 and other SANS compliant material requirements and installation specifications; or concrete barrier systems detailed in the Contract Documentation; **OR**
2. **Performance based systems** where the installation shall conform to EN 1317 (Parts 1 to 8) and/or AASHTO MASH or NCHRP350 as alternative where no MASH product is available.

11.4 ROAD RESTRAINT SYSTEMS

A11.4.1 SCOPE (continue)

The selection of use shall be based on the risk threshold as determined by the designer. Performance based systems criteria shall be specified in the specifications and measurement and payment section, and **the Contractor shall be obligated to provide a system which is fully compliant.**

Included are end wings, bullnoses, and bridge adaptors to SANS 1350; **end treatments and transitions to rigid elements** to specific project requirements and indicated on the drawings or specified by the Engineer; and end treatments, crash cushions and transitions to rigid elements of performance-based specification compliant to EN1317 and/or AASHTO MASH.

Moveable vehicle restraint systems required for traffic accommodation during construction and **truck mounted attenuators** are specified in Clauses ~~A1.5.5.4 (fencing)~~, A1.5.5.7, A1.5.6.1 and A1.5.7.11 of Chapter 1.

A11.4.2: DEFINITIONS

<u>Road Restraint Systems (RRS)</u> – are primarily used to protect vehicle occupants from impacting road furniture or hazards and vehicles reaching opposing carriageways. They are also intended to protect pedestrians, and any other entity using a roadway.

Vehicle Restraint Systems (VRS) – which include, but are not limited to:

- Longitudinal barriers
- Terminals and transitions
- Safety barriers
- Vehicle parapets
- Crash cushions
- Arrestor beds

Pedestrian Restraint Systems (PRS) – which include, but are not limited to:

- Pedestrian parapets
- Pedestrian guardrails

A11.4.2: DEFINITIONS

EN 1317 (Parts 1 to 8) – European Norm for Road Restraint Systems

- Part 1: Terminology and **general criteria for test methods**
- Part 2: Performance classes, impact test acceptance **criteria and test methods for safety barriers**
- Part 3: Performance classes, impact test acceptance **criteria and test methods for crash cushions**
- Part 4: Performance classes, impact test acceptance **criteria and test methods for terminals and transitions**
- Part 5: **Product requirements and evaluation of conformity for vehicle restraint systems**
- Part 6: **Pedestrian Restraint Systems**
- Part 7: Performance classes, impact test acceptance **criteria and test methods for terminals of safety barriers**
- Part 8: **Motorcycle Road Restraint Systems**

A11.4.2: DEFINITIONS

Containment levels – defines the ability of the RRS to restrain the design vehicle. **A containment level is achieved by the system withstanding a defined crash test influenced by the speed**, **the mass** and **impact angle** of **the vehicle which needs to be contained and redirected.**

Normalised working width – is a measure of the **deformation of a barrier under impact**, **i.e. the space needed behind the barrier in order for the system to work properly. The working width (displacement &deformation) is divided into 8 classes, W1 to W8 (EN 1317).**

AASHTO MASH – American Association of State Highway and Transportation Officials and Manual for Assessing Safety Hardware

SANS 1350 –Covers the material ,dimensional and constructional requirements for steel and aluminium W-section guardrails (guardrail, end wings ,bolts , nuts, washers and reinforcing plates .(not a restraining system)

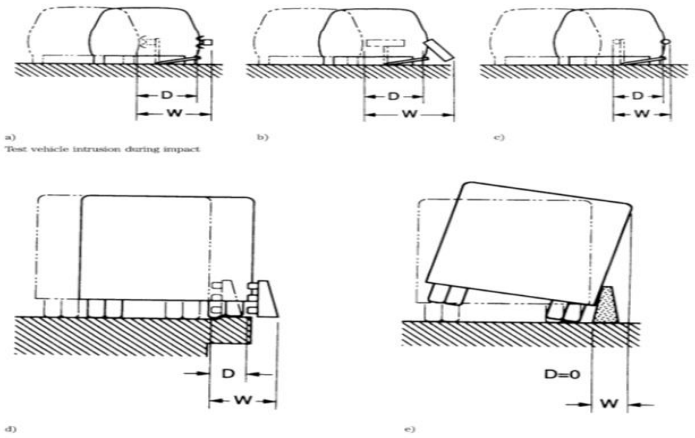
EN1317 PART 1,2,3

Containment Level (EN 1317)

Containment Level	Acceptance Test
Low angle containment	
T1	TB 21
T2	TB 22
T3	TB 41 and TB 21
Normal containment	
N1	TB 31
N2	TB 32 and TB 11
Higher containment	
H1	TB 42 and TB 11
L1	TB 42, TB 32 and TB 11
H2	TB 51 and TB 11
L2	TB 51, TB 32 and TB 11
H3	TB 61 and TB 11
L3	TB 61, TB 32 and TB 11
Very high containment	
H4a	TB 71 and TB 11
H4b	TB 81 and TB 11
L4a	TB 71 TB 32 and TB 11
L4b	TB 81 TB 32 and TB 11

Levels of normalised Working Width (EN 1317)

Classes of normalised working width levels	Levels of normalised working width
W1	W ≤ 0,6m
W2	W ≤ 0,8m
W3	W ≤ 1,0m
W4	W ≤ 1,3m
W5	W ≤ 1,7m
W6	W ≤ 2,1m
W7	W ≤ 2,5m
W8	W ≤ 3,5m



EN1317 /NCHRP 350

EN 1317

Containment level	Speed	Weight	Angle
N1	80 km/hr	1,500 kg	20°
N2	110 km/hr	1,500 kg	20°
H1	70 km/hr	10,000 kg	15°
H2	70 km/hr	13,000 kg	20°
H3	80 km/hr	16,000 kg	20°
H4a	65 km/hr	30,000 kg	20°
H4b	65 km/hr	38,000 kg	20°

NCHRP 350

Containment level	Speed	Weight	Angle
TL1	50 km/hr	2,000 kg	20°
TL2	70 km/hr	2,000 kg	20°
TL3	100 km/hr	2,000 kg	20°
TL4	80 km/hr	8,000 kg	20°
TL5	80 km/hr	30,000 kg	20°
TL6	80 km/hr	36,000 kg	20°

A11.4.2: DEFINITIONS

Performance based vehicle restraint systems provided by the Contractor shall be required where specified on the drawings or Contract Documentation, both as temporary and permanent applications, as specified for **containment level and working width** and shall conform to the product class specification criteria and containment levels as per the latest version of EN 1317 or NCHRP350/MASH based on the risk profile determined at the specific location(s) by the Engineer.

Included into the Contractors submission shall be the requirements and procedures to maintain EN 1317 and/or AASHTO MASH compliance in the event of repairs due to damage during the construction period and post construction.

The specific materials and construction requirements for repair and maintenance activities shall be provided to the Engineer together with the manufactures' specifications

Where offered and accepted or specified to be used, steel posts or other steel elements being part of an approved vehicle restraint system as tested and complying with EN 1317 and/or AASHTO MASH shall be galvanized in compliance with the requirements of SANS 121.

A11.4.2: DEFINITIONS

A11.4.5.1 GENERAL

The type of non-performance-based guardrail systems installed will be selected based on the Employer's maintenance strategy to ensure that the systems selected do not impose an onerous maintenance burden on the Employer for post construction repair or replacement requirements.

A11.4.5.2 a) Steel guardrails for erection on timber posts

Steel guardrails shall comply with the requirements of SANS 1350 and carry the SABS mark or a mark by any other SANAS approved certification body for the applicable SANS specification for 3,81 m length railings, as specified.

The dimensions of guardrails, end wings, bull noses and bridge adaptors shall be in accordance with the details indicated in the appropriate figures defined in SANS 1350. The dimensions of end treatments and alternative bridge adaptors shall be in accordance with the details shown on the drawings.

All guardrails shall be galvanized with a hot-dip zinc coating, which complies with the requirements of SANS 121.

Guardrails shall be stacked according to the manufacture's specification.

A11.4.5: MATERIALS

A11.4.5.2 b) CONCRETE

A11.4.5.2 c) GUARDRAIL POSTS

Timber posts **and spacer blocks shall be supplied in lengths and dimensions as shown on the drawings** and shall comply with the requirements of SANS 457 part 2 or part 3.

Posts shall have a top diameter of not less than 150 mm. Posts with a top diameter up to 230 mm will be acceptable, provided that posts with widely varying diameters shall not be used together in the same length of guardrail .

Timber posts and spacer blocks shall be treated in accordance with SANS 10005 with creosote that complies with SANS 616.

Timber Posts which, in accordance with the inspection methods detailed in SANS 457, exhibit a degree of cracking that would render them unfit for service shall not be used.

A11.4.5: MATERIALS

A11.4.5.2 b) CONCRETE

A11.4.5.2 c) GUARDRAIL POSTS

Steel posts, where specified for special application purposes, shall meet the requirements indicated on the drawings and be galvanized in compliance with SANS 121.

Steel base plates for timber posts, where it is necessary to install timber guardrail posts on top of a culvert or other concrete structure, and/or where the total thickness of the fill and pavement layers over such structure is less than 1,0m, the timber posts shall be fastened to the structure by means of steel base plates as shown on the drawings.

A11.4.5: MATERIALS

A11.4.5.2 d) REFLECTIVE PLATES (continue)

- Shall conform to the **colour**, **layout** and **shape requirements** of **the SADC or South African Road and Traffic Signs Manual, to be visible from both directions** and constructed to bolt onto metal guardrails or alternative attachment to other vehicle restraint systems.

- The reflectors should be securely fixed to the guardrails at specified distances or as per the drawings.

- **It should also have a 7-year lifespan** with local outdoor conditions without becoming brittle or cracking.

- Unless otherwise specified, the outer **surfaces shall be coated with class I white retro-reflective prismatic material and class III red retro-reflective material, which complies with the provisions of SANS 1519.**

- **Specification certificates must be requested from the manufacturer**.

A11.4.5: MATERIALS

A11.4.5.2 d) REFLECTIVE PLATES

- **Can be steel or plastic plates**

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A11.4.7: EXECUTION OF THE WORKS

A11.4.7.2 Construction of guardrail on timber posts

- The holes for the guardrail timber posts shall be of sufficient size to permit the proper setting of the posts and to allow sufficient room for backfilling the hole and tamping the filling**. At least 1,0 m of a post shall be embedded in the ground.**

- **Where shown on the drawings or indicated in the Contract Documentation, posts shall be set at half or quarter the standard spacings**.

- The posts, spacer blocks (if applicable) and guardrails shall be completely erected and set true to line and level, so that **the guardrails will be at the required height (600mm) above the level of the completed road shoulder.**

- Where jointed, the end of the guardrails, which **overlaps** on the side of the traffic, **shall point in the direction of the traffic movement.**

- The guardrail shall be **suitably braced to prevent any movement, and all bolts shall be tightened prior to any holes being backfilled**.

A11.4.7: EXECUTION OF THE WORKS

A11.4.7.2 Construction of guardrail on timber posts (continue)

- **End treatments** shall be constructed as shown on the drawings.
- When the **backfilling has been completed** and the bracing removed, the posts shall be rigid and vertical, and the guardrail shall be true to line and level and firmly fixed to the posts. **Excess excavated material shall be disposed of by the Contractor at no additional payment**.
- **Steel posts installed on concrete retaining walls or concrete structures as part of a timber supported guardrail section** shall be erected and fixed as shown on the drawings.
- **All guardrails shall be so erected as to have no projecting ends**, which might interfere with or endanger traffic, particularly during the installation process. The edges and the centre of the guardrails shall touch either the spacer block or the post where no spacer blocks are used. Guardrails, if specified, shall be provided with end units as shown on the drawings**. All splices of guardrails shall be at posts, and guardrails shall make contact over the entire area of the splice.**

A11.4.7: EXECUTION OF THE WORKS

A11.4.7.3 Removing, renovating and re-erecting existing guardrails on timber

- **a) Removing guardrails.** All guardrails, reflective plates and end units shall be loosened. Posts shall be carefully dug out and the holes shall be filled and compacted in 100 mm layers of suitable material from site or commercial sources . All the **material shall be transported to a store approved** by the Engineer, and **all stored in groups by type**. store approved by the Engineer, and all stored in groups by type.
- **Where material is intended for re-use**, it shall first be unpacked for inspection by the Engineer for deciding which material will be suitable for re-use. **Suitable material shall then be stored separately from material, which is unsuitable for reuse. The Contractor shall dispose of material that is unsuitable for reuse.(clause C1.2.9 Disposal of non-useable assets)**
- All **guardrail holes shall be backfilled**, and material compacted in **100 mm layers to minimum of 93 % of MDD** using material of at least G7 quality.

A11.4.7: EXECUTION OF THE WORKS

A11.4.7.3 Removing, renovating and re-erecting existing guardrails on timber

b) Renovation and painting guardrails.

- Guardrails and end treatments suitable for re-use shall be taken to a workshop for cleaning and painting. **Renovated guardrail dimensional tolerances shall comply with SANS 1350.**
- **Painting of guardrails** shall be executed as specified in Clause A13.10.7.6 of Chapter 13.
- **Damaged guardrails should not be used or retrofitted. Re-rolling of guardrails shall not be permitted**.
- **Timber posts suitable for re-use shall be cleaned and treated by applying a coating of creosote.**
- **Bolts, nuts and washers** to be reused shall be **cleaned and all rust removed and shall then be oiled.**

A11.4.7: EXECUTION OF THE WORKS

A11.4.7.3 Removing, renovating and re-erecting existing guardrails on timber posts

c) Re-erection The guardrails shall be **erected in the positions as indicated**, and **all the removed material suitable for re-use and as much supplementary new material as may be necessary shall be used**. Re-erection shall be as specified for new guardrails, including fixing the retro-reflective plates.

A11.4.7.4 Construction of concrete barrier systems.

Non-performance based concrete barrier systems shall be constructed as specified in Section A13.8 of Chapter 13 and the Contract Documentation.

A11.4.7.5 Construction of performance-based vehicle restraint systems

Construction, installation and repair (if required) of performance-based systems shall be in accordance with the manufacturers specifications, and in compliance with EN 1317 or AASHTO MASH certification requirements, as relevant.

C11.4 ROAD RESTRAINT SYSTEM

PART C: MEASUREMENT AND PAYMENT

(v) Items specifically for this Section of the specifications.

Item	Description	Unit
C11.4.5	**Additional guardrail posts for 3,81 m systems:**	
C11.4.5.1	Timber	number (No)
C11.4.5.2	Steel (drawing reference)	number (No)
C11.4.5.3	Extra over C11.4.5.1 and C11.4.5.2 for excavating holes of posts using labour enhanced methods	number (No)

The unit of measurement for additional guardrail posts shall be the number erected over and above those erected in accordance with the normal spacing shown on the drawings.

The unit of measurement for item C11.4.5.3 shall be the number of holes specified to be excavated using labour enhanced methods.

The tendered rates of items C11.4.5.1 and C11.4.5.2 shall include full compensation for supplying and installing additional posts complete as specified, excavating the necessary holes, erecting the posts, and backfilling the holes.

The tendered rate of item C11.4.5.3 shall include full compensation for excavating the necessary holes using labour enhanced construction methods and shall be paid as an extra over items C11.4.5.1 and C11.4.5.2.

Drilling and blasting will be paid for separately under item ~~C11.4.11.~~ C11.4.12.

C11.4 ROAD RESTRAINT SYSTEM

PART C: MEASUREMENT AND PAYMENT

(v) Items specifically for this Section of the specifications

Item	Description	Unit
C11.4.8	**Renovating guardrail material:**	
C11.4.8.1	Painting guardrails, end wings and bullnoses	metre (m)
C11.4.8.2	Treated posts	number (No)

The unit of measurement for sub item C11.4.8.1 shall be the metre of single guardrail, whether straight or curved, or end units painted as specified, the length of which shall be measured in accordance with the measurements of the guardrail elements after dismantling.

The unit of measurement for subitem C11.4.8.2 shall be the number of treated posts.

The tendered rates shall include full compensation for the work as specified in Clause ~~A11.4.7.2b)~~ A11.4.7.3b) surface preparation, applying all the coats of paint, repairing any damaged surfaces, and all materials and construction plant necessary for completing the work including the loading, transporting to and from the workshops, off loading and storing of the material.

D11.4 ROAD RESTRAINT SYSTEMS

PART D :GUARANTEES AND COMPLIANCE CERTIFICATES

CONTENTS

D11.4 ROAD RESTRAINT SYSTEMS

PART D:GUARANTEE AND COMPLIANCE CERTIFICATES

D11.4.1 SCOPE

Refer to Clause A11.4.1 for performance-based systems *which comply to the EN 1317 and/or AASHTO MASH* or NCHRP350 as alternative where no MASH product is available.

D11.4.3 PERFORMANCE GUARANTEE REQUIREMENTS

D11.4.3.1: PERFORMANCE BASED VEHICLE RESTRAINT SYSTEMS

- **Suppliers of Performance Based Systems will be required to obtain, from the foreign testing facility where the product was tested, a Type Approval Report and submit it to a SANAS accredited Certification Body for independent verification at the cost of the supplier. Once verified, the Certification Body will conduct auditing of the product being manufactured, to ensure that it is the same product as described in the Type Approval Report, which will verify the testing report provided to the Engineer.**
- The **manufacturer of the RRS will be required to issue a limited material defects warranty for a period of not less than 12 months.**
- **The entity that is tasked with the installation of the RRS system must be a certified installer and certify that the system has been installed in accordance with the manufacturers installation guidelines in order to comply with the crash testing conditions.**

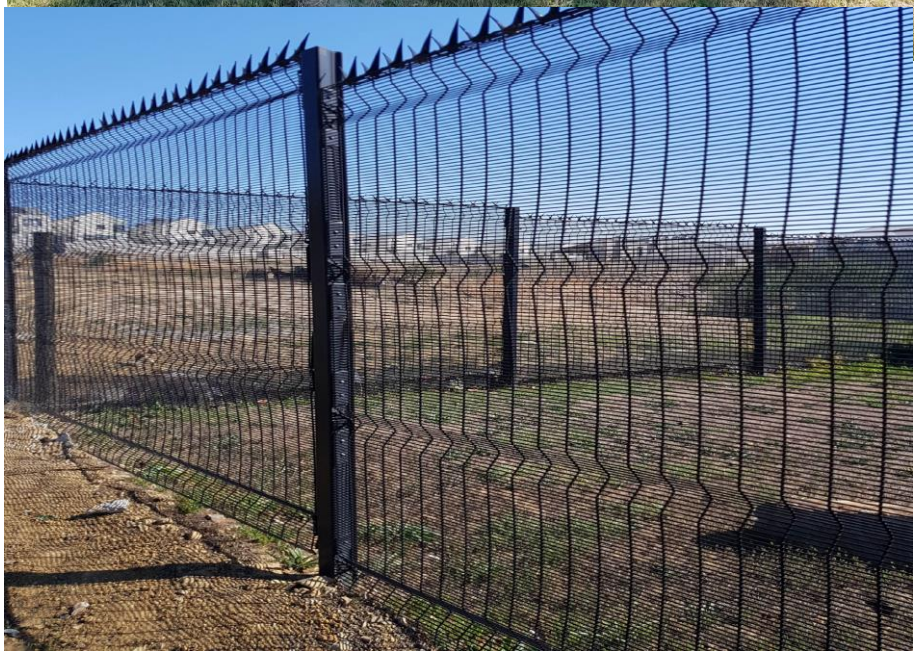
D.11.4.10 REMEDIAL WORKS

It is a requirement that the installer and repairers of a performance-based system issue a certificate of compliance every time the work has been completed.

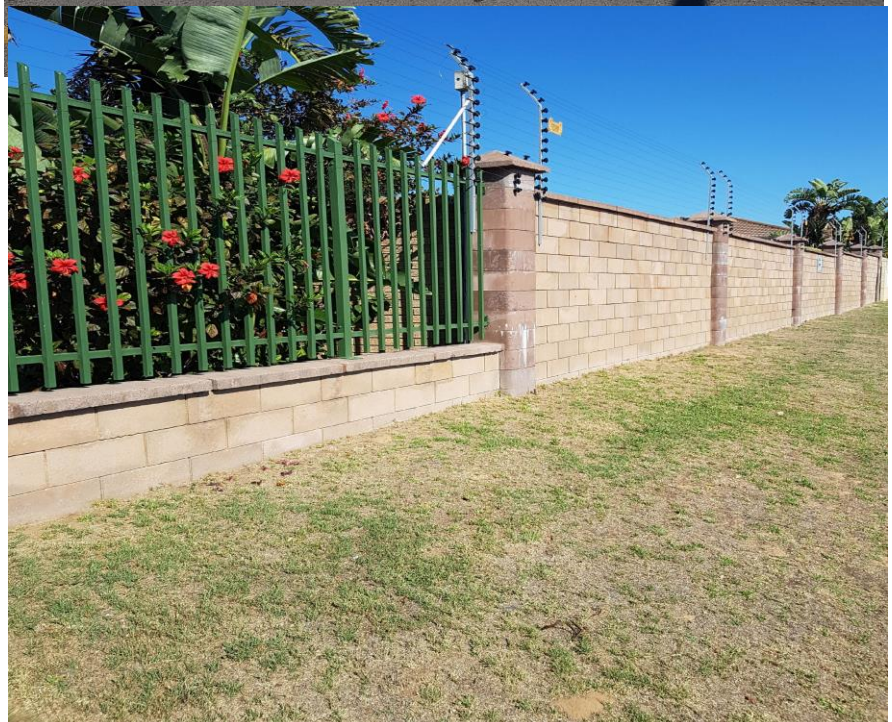
QUESTIONS

11.5 FENCING

11.5 FENCING



11.5 FENCING



11.5 FENCING

PART A: SPECIFICATIONS

A11.5.1 SCOPE

A11.5.2 DEFINITIONS

A11.5.3 GENERAL

A11.5.4 DESIGN BY CONTRACTOR / PERFORMANCE BASED SYSTEMS

A11.5.5 MATERIALS

A11.5.6 CONSTRUCTION EQUIPMENT

A11.5.7 EXECUTION OF WORKS

A11.5.8 WORKMANSHIP

PART B:LABOUR ENHANCEMENT

PART C:MEASUREMENT AND PAYMENT

PART D:GUARANTEES AND COMPLIANCE CERTIFICATES

11.5 FENCING

A11.5.1 SCOPE

This Section covers the **erecting of new fences** and associated works, the **repair** or **improvement of existing fences and moving of existing fences** where necessary along the boundaries of the road reserve and elsewhere as indicated on the drawings or as specified by the Engineer. Also included shall be the **erection of temporary fences** as well as **the removal and stacking of fencing where specified by the Engineer.**

Except when otherwise specified or approved**, new or temporary fences shall be erected before construction on a particular section of the road** is commenced with, before other properties are occupied for construction related work, or **before temporary bypasses are opened to traffic**. The requirement to **ensure the safety of road users and protection of property and other rights of the public against access over property lines by vehicles, pedestrians and animals shall be enhanced by functional fences installed and maintained at the appropriate time and position**

A11.5.3 GENERAL

The Engineer and Employer shall identify and point out any cadastral beacons to the Contractor prior to any clearing or digging of holes is undertaken for fencing purposes. Any **disturbed or removed cadastral beacons shall only be replaced by a registered Land Surveyor.** Cadastral beacons shall be clearly demarcated to avoid disturbance

A11.5.3.1 Protection of livestock and property

- **From the time of the site being handed over up to the date of the final completion of the works by the Contractor shall take all measures necessary for preventing the ingress of vermin, and for protecting and controlling vehicles, pedestrians, livestock, other property, etc, on the sections of the properties affected by his operations**

- **No fences shall be cut for access without the approval of the Engineer, and consultation with the owner/rights holder of the adjoining property**

- **The temporary fencing shall be maintained in a good order during construction operations .**

A11.5.3 GENERAL

A11.5.3.1 Protection of livestock and property (continue)

When the replacement of fences is required, the Contractor shall either erect the new fence before removing the old fence, or alternatively engage with the adjoining landowner(s)/rights holders to temporarily remove their stock from the affected camps to enable him to remove the old fence before erecting the new fences. Payment for any additional cost of restricted working conditions in replacing of fences shall not be made but included in the various rates for the replacement of fencing

.

Payment for the protection of livestock during fencing operations, but excluding the cost of erection of temporary fences, shall be included in the amounts tendered for the Contractor's general obligations as specified in Clause A1.3.2 and Section C1.3 of Chapter 1.

A11.5.4 DESIGN BY CONTRACTOR / PERFORMANCE BASED SYSTEMS

Not generally required for Section A11.5. High security fencing may in certain circumstances be required to be provided under performance-based specifications as specified in the Contract Documentation.

A11.5.5 MATERIALS

A11.5.5.2 Straining posts ,stays ,standards and droppers

Straining posts, stays, standards and droppers shall be of the type, size and length indicated on the drawings.

Timber posts shall comply with the requirements of SANS 457 part 2 or part 3. Timber posts shall be treated in accordance with SANS 10005 with creosote that complies with SANS 616 .

Tubular straining posts and stays shall have a wall thickness of at least 2,95 mm and shall be galvanized in accordance with SANS 121 or shall be painted as specified in Section A13.10 of Chapter 13 as may be required on the drawings. Unless otherwise shown on the drawings, all tubular posts shall be provided with a 230 mm x 230 mm footplate and a pressed-steel or cast-iron cap. Tubular stays shall have a nominal bore of at least 60 mm.

Unless otherwise specified or shown on the drawings, rolled steel posts shall be 15 or 22 kg/m rails and standards shall be 2,3 kg/m Y-sections.

Steel droppers shall be at least 0,56 kg/m ridgeback-pattern droppers, unless otherwise specified or shown on the drawings. Steel droppers shall be provided with a protective coating of bitumen or other approved material.

A11.5.5 MATERIALS

A11.5.5.3 Bolts for stays

Bolts shall be galvanized steel bolts of the required length and diameter, which shall not be less than 12 mm. All the necessary bolts, nuts and washers, shall be supplied with each post. All steel bolts, nuts and washers shall have a hot-dip (galvanized) zinc coating, which complies with the requirements of SANS 121.

A115.5.4 Wire

Barbed wire shall comply with the requirements of SANS 675 for class A zinc coating, and shall be one or more of the following types:

- High-tensile-grade steel single-strand 3,15 mm x 2,50 mm oval-shaped zinc-coated wire, with a 2,82 mm equivalent diameter and with a 1,8 mm diameter barb
- High-tensile-grade steel single strand 2,80 mm x 1,90 mm oval-shaped zinc-coated wire, with a 2,31 mm equivalent diameter and with a 1,6 mm diameter barb. This **shall not be used below 500 mm above ground** where there is risk of veld fire such as where the dry grass density exceeds 1,0 kg per square metre.
- Mild-steel-grade zinc-coated double-strand uni-directional-twist wire, each strand 2,50 mm in diameter with a 1,8 mm diameter barb, for use at any height above ground.

A 11.5.5 MATERIALS

A 11.5 .5 4 Wire (continue)

Barbed wire shall be spaced at a maximum of 150 mm apart.

Smooth wire shall comply with the requirements of SANS 675 for class A zinc coating and shall be of the types specified below.

•Straining wire hightensile-grade steel **4,0 mm** diameter zinc-coated wire for **use** at **any height above ground**.

•Fencing wire high-tensile-grade steel **2,24 mm** diameter zinc-coated wire for **use above 500 mm** above ground where there is a risk of veld fire.

Tying wire shall comply with the requirements of SANS 675 for class A zinc coating and shall be 2,50 mm diameter mild-steel zinc coated wire for tying fencing wire to standards and droppers and 1,6 mm mild-steel zinc-coated wire for tying netting and mesh wire to the fencing wire.

A11.5.5 MATERIALS

A11.5.5.5 Diamond mesh

Diamond mesh (chain-link fencing material) shall comply with the requirements of SANS 1373.The nominal diameter of **the wire shall be 2,5 mm and the mesh size shall be 63 mm x 63 mm and fully galvanized.**

A11.5.5.6 Wire netting

Wire netting shall be fully **galvanized mild-steel wire with a minimum diameter of 1,8 mm with 75 mm hexagonal mesh**

A11.5.5.7 Barbed-tape security barrier

Barbed-tape security barrier shall comply with the requirements of SANS 1620. The high-tensile steel wire shall be heavily galvanized (class A) .

A11.5.5.8 Gates

Gates shall be manufactured to the dimensions and details shown on the drawings. Gates shall be zinc-coated as specified in SANS 121 or painted as specified in Section A13.10 of Chapter 13 .

A11.5.5 MATERIALS

A11.5.5.9 Timber posts for wire mats

Timber posts of the required length and diameter for holding down wire mats where the fence crosses streams shall comply with the requirements of Clause A11.5.5.2.

A11.5.5.10 Hinge joint mesh

Hinge joint mesh wire shall be zinc-coated in accordance with SANS 675. It shall consist of 2,0 mm diameter high tensile line wires and 2,0 mm diameter mild steel vertical stay wires twisted or interlocked together in a rectangular grid. Unless otherwise indicated on the drawings or Contract Documentation, the **vertical and horizontal wire spacing shall both be 100 mm**. The height of the mesh shall be as indicated on the drawings, or as specified under the measurement and payment item.

A11.5.5.11 Concrete.

A11.5.5.12 Alternative materials

Alternative materials for pedestrian, security or game fences may be specified in the Contract Documentation.

A11.5.7 EXECUTION OF THE WORKS

A11.5.7.1 Classification of Materials

~~All excavations for pitching, stonework and protection against erosion shall be excavated in the position and to the required dimensions. Overbreak in width or depth, unless specified by the Engineer, shall be in filled by the Contractor and shall not be measurable for payment~~.(**NEED TO DELTE PARAGRAPH** .)

All excavations under this Section shall be classified as specified under Clause A11.1.7.1 or B11.1.7.1

A11.5.7.2 Types of fencing

The following types of fences shall be erected in accordance with the dimensions shown on the drawings.

- **Stock-proof fences**
- **Vermin-proof fences**
- **Pedestrian fences**
- **Security fences**
- **Game fences(new)**

A11.5.7 EXECUTION OF THE WORKS

A11.5.7.3 Clearing and grubbing the fence line

Prior to the removal of indigenous vegetation, verification of compliance with Environmental legislation shall be undertaken. (search and rescue)

The fence line shall be cleared over a 2,0 m wide strip, 1,0 m on either side of the centre line of the fence and surface irregularities shall be smoother and graded so that the fence will follow the general contour of the ground. Clearing and grubbing and the removal of trees shall be executed as specified in Clause A1.6.7 of Chapter 1.

A11.5.7.4 Erecting straining posts and standards

Straining posts shall be erected at all terminal points, gates, low points (as required), corners and bends in the fencing and at all junctions with other fences. Shall not be spaced further apart than shown on the drawings. **The length of posts above ground shall be such that the correct clearance between the lowest wire and the ground can be obtained**.Shall be set in holes and provided with concrete bases to the dimensions shown on the drawings. **Care shall be taken not to destroy or disturb any cadastral boundary beacons particularly at corner or bends in fences**. Any disturbed or destroyed cadastral beacons shall be re-instated by the Contractor at his cost

A11.5.7 EXECUTION OF THE WORKS

A11.5.7.4 Erecting straining posts and standards (continue)

All **straining posts shall be braced by means of stays or anchors as shown on the drawings**

<u>Standards</u> shall be firmly planted into the ground at the spacing's shown on the drawings . The spacing of standards between any two successive straining posts shall be uniform and not greater than that shown on the drawings. **In rock or hard material standards shall be either driven or set in holes drilled into the rock**. The size of drilled holes shall provide a tight fit to the standards. Care shall be taken when driving steel standards to prevent their buckling or being damaged.

After the straining posts and standards have been firmly set in accordance with the foregoing requirements, fence wires shall be attached thereto at the vertical spacing shown on the drawings

A11.5.7 EXECUTION OF THE WORKS

A11.5.7.5 Erecting fence wires

All fencing wire shall be tied to the standards or posts to prevent the wires from being displaced or becoming loose. **Generally tensioned wires shall be located to the outside of the road reserve posts to ensure stressing the fence due to animals leaning on fences is transferred directly to the posts rather than to the tie wires**. The wire shall be carefully tensioned without sagging, and true to line, care being exercised not to tension the wire to such an extent that it will break, or that end, corner, straining or gate posts will be pulled out, or that it will be easily damaged during veld fires. **The effects of temperature during tensioning shall be considered to prevent excessive under or over tensioning due to extreme hot or cold weather**. Each strand of fencing wire shall be securely tied in the correct position hard up to each standard with soft galvanized tying wire. The tying wire for each strand shall pass through a hole or notch in the standard, while **the ends of the tying wire shall be wound at least four times around the fencing wire to prevent it from moving in a vertical direction**.

A11.5.7 EXECUTION OF THE WORKS

A11.5.7.6 Erecting diamond mesh or wire netting

Where **vermin-proof, pedestrian or security fences are erected, or where specified the wire netting or diamond mesh shall be stretched against the fence and properly tied to the fencing wire as shown on the drawings.** The diamond mesh or wire netting shall be secured by soft tying wire at 1,2 m centers along the top and bottom wires and at 3,0 m centers along each of the other fencing wires, unless otherwise shown on the drawings.

In the case of vermin-proof fencing, **vermin shall be prevented from creeping under the fence by either one of the two methods** described below as specified:

- **By folding back, the bottom 130 mm of the wire netting** so that it lies flat on the ground and by tightly packing stones (having a minimum dimension of 200 mm) end to end on this flap to secure it in position.
- **By embedding the lower 130 mm of the wire netting** in the ground and thoroughly compacting the earth around it on both sides, to secure the netting.

A11.5.7 EXECCUTION OF THE WORK

A11.5.7.7 Erecting special purpose fencing

Special purpose fencing may be specified where higher security or access control is required. This may include additional elements appended to standard fencing such as barbs to electrification or complete fencing systems. Due to the variability in such fencing system, the materials, standards and specifications shall be detailed in the Contract Documentation, drawings and measurement and payment sections.

A11.5.7 EXECCUTION OF THE WORK

A11.5.7.8 Closing openings under fences

Special purpose fencing may be specified where higher security or access control is required. This may include additional elements appended to standard fencing such as barbs to electrification or complete fencing systems. **Due to the variability in such fencing system, the materials, standards and specifications shall be detailed in the Contract Documentation, drawings and measurement and payment sections.**

A11.5.7 EXECUTION OF THE WORKS

A11.5.7.8 Closing openings under fences

At ditches, streams, drainage channels or other depressions **where the fence cannot be erected so as to follow the general ground contour, the Contractor shall close the opening under the fence with horizontal barbed wires at 150 mm distances, stretched between additional posts or straining posts as shown on the drawings or directed by the Engineer.** In the case of pedestrian, vermin-proof and security fences the opening shall be covered with strips of wire netting or diamond mesh 1,0 m wide, fixed to the barbed wires.

In the case of larger streams where damming of debris against the fence would constitute a hazard, the opening below the bottom fencing wire shall be closed with loose hanging wire nets. If it should be necessary to keep the bottoms of the mats on the ground, the Engineer may order that timber posts or pipes be fixed horizontally to the bottom ends of the diamond-mesh strips.

A11.5.7 EXECUTION OF THE WORKS

A11.5.7.9 Existing fences

Where a new fence joins an existing fence whether in line or at an angle, the new fence shall be erected with a new straining post positioned at the terminal of the existing fence.

Where fences require moving, the Contractor shall re-use all the material, declared to be suitable for this purpose by the Engineer, plus such new material as may be required to put up the fence again to the standard specified for new fences. The Engineer shall not be responsible for any delays or costs arising from the breaking of re-used wire during straining.

A11.5.7.10 Erecting gates

Gates shall be erected at the positions indicated by the Engineer. The clearance below the gates shall not exceed 75 mm with the gates closed.(**check statutory requirements for access control)**

A11.5.7.11 Temporary fencing and gates

If required, the Contractor shall erect temporary fencing and gates In accordance with the drawings, Contract Documentation. **When no longer required, the temporary fencing and gates shall be dismantled and removed**.

QUESTIONS

11.6 ROAD SIGNS

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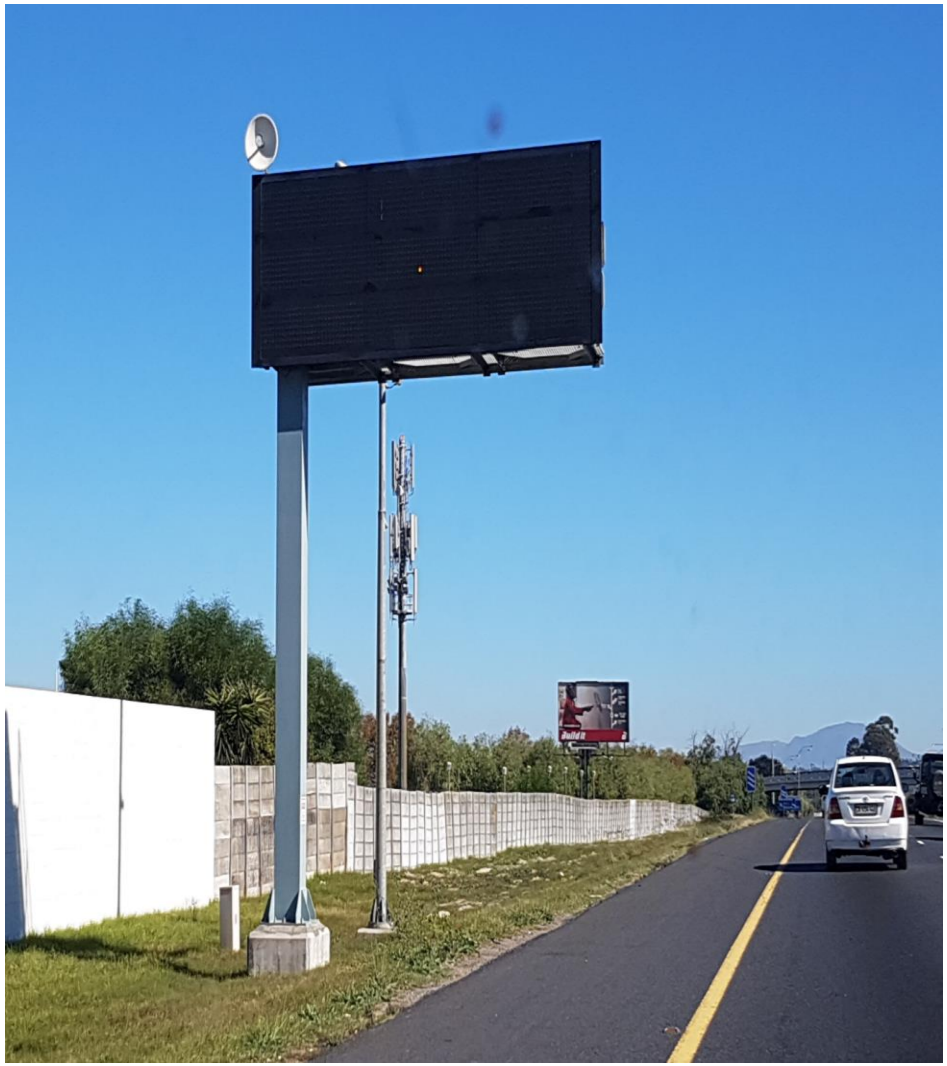
better roads

11.6 ROAD SIGNS



11.6 ROAD SIGNS

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A11.6 ROAD SIGNS

A11.6.1 SCOPE

This Section covers the **supply and erection of permanent and temporary road signs and traffic signs** alongside, over the carriageway, ramps and crossroads at intersections, at interchanges, and at the locations indicated on the drawings and Contract Documentation

All road signs and traffic signals shall be of the applicable standard regulatory, warning, guidance and information signs or traffic signal requirements **shall be in accordance with the SADC and the South African Road Traffic Signs Manual**; as applicable, except where otherwise indicated on the drawings or in the Contract Documentation .

The **installation or relocation of permanent traffic signals, cabling and controllers, if required, shall be as specified in the Contract Documentation** . The construction of ducting and concrete footings shall be constructed as specified in Section A2.2 of Chapter 2 and Chapter 13 respectively. **The provision and operation of temporary or moveable traffic signals for traffic accommodation and other purposes shall be the undertaken by the Contractor as priced items.**

•The m**anufacture and erection of overhead road sign gantries including footings shall be as detailed in Section Chapter 13**. The installation or attachment of road signs thereto shall be undertaken under this Section.

A11.6.5.2 MATERIALS

a) Structural steel

Shall comply with the requirements of BS 4360 for the type of steel specified or shown on the drawings. Where specified, all structural steel, including tubes shall be galvanized in accordance with the requirements of SANS 121 .Steel tubes shall comply with the requirements of SANS 657.

b) Bolts, nuts and rivets

Steel bolts and nuts shall comply with SANS 135 or SANS 1143. Aluminium bolts and nuts shall be manufactured from alloy B51S or D65S. Stainless steel bolts, nuts and fasteners shall comply with SANS 1700-5-8, SANS 1700-5-9 or SANS 1700-5-10.

All steel bolts, nuts and washers shall have a hot-dip (galvanized) zinc coating, which complies with the requirements of SANS 121.

Blind rivets used for fixing road signboards to square tubing framework shall be 4,8 mm diameter rivets of sufficient length manufactured from or coated with a material that prevent corrosion to the rivets or fastened members through electrolytic action. Hardened blind or aluminium rivets shall be used for attaching aluminium sections.

A11.6.5.2 MATERIALS

c) Steel plate and steel profiles

Steel plate for road signs, prior to the application of any reflective sheeting or painting, shall be 1,4 mm thick Z275 galvanized steel plate, which has been treated on both sides to the paint system requirements specified inn Table A11.6.5-1.

The reverse side of a STOP sign R1 and all its derivatives shall be painted white. The reverse side of all other signs shall be dark grey.

Where a non-reflectorised road sign is required, the face shall be painted with only the specified topcoat.

Steel profiles .Standard sign profiles shall be 200 mm steel sections with a thickness, prior to the application of any reflective sheeting or painting, be 1,0 mm thick Z275 galvanized steel plate, which has been treated on both sides to the paint system requirements specified in Table A11.6.5-1).

d) Other plate material

Temporary roadworks delineators signs TW401 and TW402 shall be manufactured from a flexible material and shall comply with the requirements of SANS 1555. These signs shall either bend or break under vehicular impact and cause minimal damage to vehicles on impact with them. Steel shall not be used in either the signs or the footings.

A11.6.5.2 MATERIALS

e) Aluminium and aluminium composite

Aluminium flat plate shall be manufactured from grade 5251.H.3 alloy and shall comply with the requirements of BS 1470 and **shall be 2,0 mm in thickness**.

Aluminium composite shall be a minimum of 3,0 mm thick composite flat plate, comprising a polyethylene core and two bonded aluminium cover sheets (AlMg1, EN AW-5005 A alloy), each measuring 0,3 mm inn thickness, with a traffic grey modified polyester system lacquer coating, and comply to the specifications of SANS 1519-2.

f) Paint

All paints used shall comply with the requirements of SANS 1519-2, including the standards mentioned therein.

h) Timber posts for road sign supports

Timber posts for road sign supports shall conform to the requirements of SANS 754, shall be equal to or better than strength group B timber posts and shall be affixed with the SABS mark. The posts shall be treated as specified in Clause A11.4.5.2b)(i). **The exposed surface and any holes drilled shall be given two coats of the specified preservative as re–treatment .**

A11.6.5.2 MATERIALS

g) Retro-reflective material

Retro-reflective material **shall be supplied in the following grades** and shall comply with the requirements of SANS 1519:

- **Class I material - 7-year warranty grade**
- **Class III material - 10-year warranty grade**
- **Class IV a) and b) material – 10 to 12-year warranty grade**

The use of materials from different manufactures or different batches for the same colour shall not be used on any one sign.

Materials from different manufacturers shall not be overlaid without specific approval of the Engineer and subject to such conditions as the Engineer may impose

i) Corrosion-protection tape

Corrosion-protection tape used between aluminum and steel shall be a black PVC tape not less than 0,25 mm in thickness, shall be resistant to ultra-violet rays, and shall have an adhesive backing. The breaking strength of the material shall be more than 3,5 kN/m.

A11.6.5.2 MATERIALS

j) Silk-screening and digital printing

Silkscreen or digital printed materials shall comply with the requirements of SANS 1519-1 and the screening or printing of road signs shall only be acceptable after verification of endorsement by the manufacturer of the retro-reflective material to provide an equal or better service life to the specified retro-reflective material

k) Black vinyl

Black vinyl material shall provide an equivalent warranty as the lowest class of retro reflective material (7 years) used on a road sign. Black vinyl shall comply with the requirements for non-reflective sheeting in SANS 1519-1.

l)Concrete

All concrete work shall be carried out in accordance with the requirements of Section A13.4 of Chapter 13, read together with the provisions of Clause A11.1.5.4.

m) Alternative materials

Alternative materials for road signage elements may be specified in the Contract Documentation.

A11.6.7 EXECUTION OF THE WORK

A11.6.7.2 Manufacturing of road signboards and supports

a) Road signboards

Road signboards shall be manufactured by a manufacturer of road signs being affiliated to a recognised traffic sign manufacturer association ~~such as SARTSMA~~ or a permit holder under SANS 1519-2. Permanent road signs shall be newly manufactured. Temporary road signs may be previously used signs, however their condition shall be compliant to the specifications, and shall be subject to the acceptance by the Engineer.

Shall be manufactured strictly in accordance with the details on the drawings. , from either steel plate or steel profiles, or aluminium plate or aluminium composite sections according .

Retro-reflective material shall be affixed to the sign face strictly in accordance with the specifications of the manufacturer of the retro-reflective material.

All lettering shall be accurately affixed to the signboards after the background material has been applied.

Where possible, road signboards shall be manufactured as one unit. If **manufactured in more than one unit, the completed units shall be assembled in the workshop prior to delivery** to ensure that all sections and legends fit together properly. Joints in road signboards shall be provided only at locations and to details as shown on the drawings.

A11.6.7 EXECUTION OF THE WORKS

Steel and aluminium plate road signboards

All road signs exceeding 600 mm in length (i.e., measured horizontally) shall be stiffened by a supporting framework as shown on the drawings.

Each sign that does not require a supporting framework shall have two mounting holes of 12 mm diameter each located 25 mm from the sign edges so that the sign may be erected on a vertical post.

Direct contact between aluminium and any supporting steel framework shall be avoided by adhering corrosion protection tape to the parts of the board in contact with the steel frame.

Steel profile road signboards

Steel profile road signboards shall be manufactured in accordance with the details on the drawings and shall not be joined longitudinally unless the length of the sign exceeds 6,0 m. In such a case it shall be manufactured in sections of equal length and joined in accordance with the details on the drawings..

A11.6.7 EXECUTION OF THE WORKS

Steel profile road signboards (continue)

Where possible, letters across the joint between two sections should be avoided. **If it cannot be avoided, the letters concerned shall be bisected on the joint and the edges properly pressed home, however, prismatic retro-reflective materials are not required to be folded around the radius, but the ends shall be securely bonded to the panels**.

Composite plate road signboards

Road signboards shall be manufactured as specified for steel and aluminium plate road signboards as specified in Clause A11.6.7.2a).

b) Welding

All welding of steelwork shall be carried out in accordance with the standards laid down in BS 5135. All welding shall be done before painting, powder coating or galvanizing. Prepainted steel sheets shall not be welded.

c) Structural steel

The relevant provisions for Structural Steelwork in Section A13.9 of Chapter 13, shall apply to all steel supporting structures for road signs.

A11.6.7 EXECUTION OF THE WORKS

d) Galvanizing

Where the galvanizing of structural-steel frames and signboard supporting structures is specified, it **shall be done as far as Is practicable after welding**. Where, however, this is not practicable, the steel sections shall be galvanized before assembly and then welded. All welds shall be thoroughly cleaned, loose material removed, and dressed, after which the welds shall be coated with two coats of an approved zinc-rich paint.

Unless otherwise specified in the schedule of quantities or the Contract Documentation, galvanized steel will not require painting.

e) Road sign supports

Road sign supports shall be constructed in accordance with the details shown on the drawings.

f) General

Where details for the construction of road signboards, the frame work of the road signboards and their attachment to the supporting steel framework are not shown on the drawings, the Contractor himself shall design them and submit the details to the Engineer for approval before manufacture.

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.3 Road sign faces and painting

a) **Colours, symbols and legends.** Paint colours, symbols, legends and borders used on **road signs shall comply with the applicable statutory provisions, and also with the requirements of the SADC and South African Road Traffic Signs Manual.**

b) Preparing surfaces and applying paint and retroreflective sheeting

The preparation of surfaces and application of retroreflective sheeting shall be done in strict accordance with the recommendations of the sheeting manufacturer.

Road signboards with a semi-matt finish manufactured from pre-painted plate or composite plate of the specified colour or aluminium road signs shall not require pre-treatment or painting. Galvanized frameworks will not require painting

c) Date of manufacture . The **manufacturer shall paint an identification code** on the reverse side of every completed road signboard in the lower corner nearest to the road surface in a position where the code will not be obscured by the framework or the erection posts. **The code shall be in the form X-MM-JJ where X is the letter used by the manufacturer to Identify the manufacturer and MM·JJ Indicates the month and year of the manufacture. These letters shall be painted in white (black on STOP signs) and shall not be larger than 50 mm in height.**

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.3 Road sign faces and painting

c) Date of manufacture .

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.3 Road sign faces and painting

d) Advertisements

No advertisements may be displayed on or attached to any part or any side of a road signboard or a road sign support.

e) Application of retro-reflective material

Where applied to pre-painted, pre-formed steel sections, retro-reflective material shall be affixed to the sign face strictly in accordance with the specifications of the manufacturer of the retro-reflective material.

A11.6.7.4 Storage and handling

Finished road signs shall be packaged to prevent damage from signs rubbing against each other and stored vertically. Large signs may be shipped uncrated or unpacked in open or closed trucks or trailers, provided the signs are secured vertically in racks to prevent damage.

On site, signs and signboards shall be stored on wooden, steel or plastic spacers in the vertical position so that the signs are not in contact with the ground. There shall be **sufficient space between the finished road signboards to permit free air circulation and moisture evaporation**

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.4 Storage and handling (continue)

When required, existing or newly erected road signs shall be fully or partially covered with burlap or other approved adequately ventilated material to obscure destinations that are temporarily Inapplicable or irrelevant

The **following shall not be allowed on the completed sign face**:

- **Drilling of holes**, except for the fastening of overlays
- **Application of any form of adhesive**
- **Cleaning with any chemicals** that are not specifically approved by the manufacturer of the retro-reflective material.
- **Covering the sign face with an impermeable material** that does not allow free circulation of air during storage.

All signs damaged during offloading, storage and handling shall be repaired at the Contractor's cost.

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.5 Erecting road signs

a)Position . Road signs shall be erected in the positions shown on the drawings or specified by the Engineer.

b)Excavation and backfilling

Excavations for the erection of road signs shall be made according to the dimensions shown on the drawings Where the excavations are to be backfilled with soil a 1:12 cement: soil mixture shall be made. The soil or soil-cement mixture shall then be placed at optimum moisture content in 100 mm thick layers in the excavation and shall be compacted to a minimum of 93 % of MDD.

Where posts or structures are to be fixed in concrete, or where concrete footings are to be cast the **concrete, formwork and reinforcement shall comply with the requirements of ~~Section A13.4 of~~ Chapter 13.**

This Clause shall apply to ground-mounted signs only. Excavating and backfilling for the foundations of overhead steel structures are ~~specified and~~ measured in ~~Section A13.1 of Chapter 13~~ in this section .

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.5 Erecting road signs

c) Erection

Road signboards must **be inspected by the Engineer before the boards are taken from the manufacturer to the site for erection** the Contractor shall notify the Engineer at least one (1) week before the said inspections are required

Road signs shall be erected strictly in accordance with the details and instructions on the drawings . **The Contractor shall take into account the wind speed factor during installation.**

A **road sign identification number** (as indicated on the layout drawings) shall be painted with white enamel paint on the reverse side of the road signboard, above the month and year of manufacture in 50 mm high letters and numbers on the side closest to the road surface. **Identification numbers on overhead signs shall be painted in a position that is visible from the road shoulder .**

All vegetation obstructing the new or replaced sign board shall be removed prior to installation and disposed of by the Contractor at no additional payment in order to provide clear visibility of the sign to road users.

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.5 Erecting road signs

***d)* Field welding**

All welding done during erection shall comply with the requirements for welding during manufacture.

e) On-site painting

All painting done after the road signs have been erected shall comply with the requirements for painting during manufacture.

All places where the paintwork has been damaged during erection shall be repaired by the Contractor at his own cost to the satisfaction of the Engineer.

f) Time of erection

Road signs shall be erected immediately prior to the road being opened to public traffic, unless otherwise specified by the Engineer.

g) General

All destinations and route numbers shown on the drawings shall be subject to amendment, and confirmation of the details shall be obtained from the Engineer before any particular signs may be made.

A11.6.7 EXECUTION OF THE WORKS

A11.6.7.6 Protection and maintenance

The Contractor shall protect the completed road signs against damage until they have been finally accepted by the Employer, and he shall maintain the road sign until the completion of the contract.

A11.6.7.7 Dismantling, storing and re-erecting existing road signs

Where specified by the Engineer, the **Contractor shall dismantle and remove existing road signs, store them, and re-erect them at new positions indicated. Dismantling shall be done with the least damage possible to the signs**.

Where specified by the Engineer, the signs shall be repainted or repaired, and new materials shall be used for part or all of the supporting structure.

The removal of existing signs shall be delayed until after replacement signs are erected, unless not physically possible. Regulatory and warning signage shall in all circumstances be displayed at all times. Where dismantling of an existing sign is required before erection of the replacement sign, the dismantling shall not take place until immediately before work is to commence on the replacement, and the replacement shall be completed, and the new sign displayed within 72 hours thereafter.

PART C :MEASUREMENT AND PAYMENT

C11.6.5 Excavation and backfilling for road sign support including gantry footings .(not applicable to kilometre posts)

The unit of measurement for items C11.6.5.1 and C11.6.5.2 shall be the cubic metre of excavation measured in place according to the neat dimensions of the footings or excavations as shown on the drawings or directed by the Engineer. In the case of timber posts not in concrete, the plan area of the excavated hole shall be taken as 0,36 m^2, irrespective of the actual size of the excavated hole. For gantry footing , it shall be the dimensions as per the drawings plus 0.5 m

NOTE (page 11-66) Concrete, formwork and reinforcing steel for road sign gantry footings shall be measured and paid for in accordance with the provisions of ~~Section A13.4~~ of Chapter 13, but such payment items shall appear under this Section in the schedule of quantities.

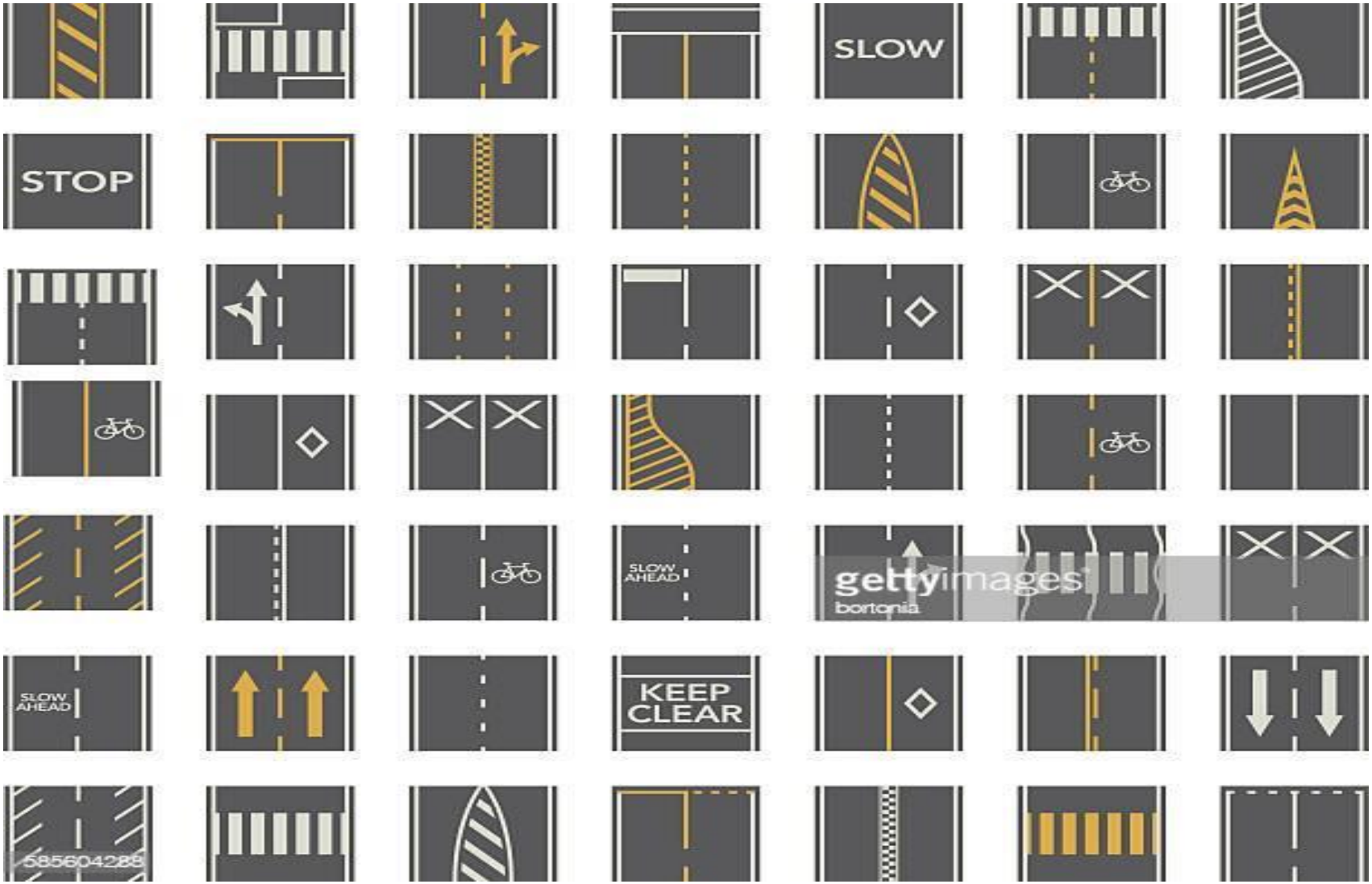
C11.6/13.4.1 &2 :Cast in situ concrete

C11.6/13.2.1 :Formwork

C11.6/13.3.1 :Reinforcement

QUESTIONS

11.7 ROAD MARKING AND ROAD STUDS



11.7 ROAD MARKING AND ROAD STUDS

11.7 ROAD MARKING AND ROAD STUDS

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A11.7 ROAD MARKINK AND ROAD STUDS

A11.7.1 SCOPE

This Section covers the **temporary and final marking** of the road surface with lines and symbols **and the supply and fixing or removal of retro-reflective or solar powered road studs** as indicated on the drawings.

All road markings shall be of the standard regulatory, warning and guidance markings as detailed on the drawings and in accordance with the SADC and South African Road Traffic Signs Manuals.

Road marking application shall be based on materials conforming to various SANS requirements and divided **either on method and type of material application specification; or alternatively based on performance-based application**, where the road marking performance shall be monitored and measured, and payment based on such measured performance over time.

Performance based application shall not be applicable to first road marking application applied after road surfacing, resurfacing or bitumen rejuvenation

The **Contractor shall provide temporary traffic control facilities** in accordance with the specifications given in Section A1.5 of Chapter 1 to ensure traffic safety where work is being executed.

A11.7.4 DESIGN BY CONTRACTOR /PERFORMANCE BASED SYSTEMS

A11.7.4.1 Road Marking

Where indicated under the specifications and measurement and payment, road marking shall be a performance based application where **payment shall be based on specified achieved criteria such as reflectivity, luminance, skid resistance ,and durability measured over fixed periods.**

A11.7.4.2 Road Studs

Where indicated under the specifications and the measurement and payment, road studs shall be a performance based application.

A11.7.5 MATREIALS

a) Marking Materials

The responsibility for the selection of the appropriate road marking materials for road markings to ensure conformance with the requirements of this specification rests with the Contractor. **The road marking materials shall provide the characteristics for retro-reflectivity, luminance, skid resistance and durability as required in the material specifications.**

Where **thermoplastic**, also known as hot melt plastic, or Methyl Methacrylate (MMA), also known as cold plastic, is used, **the Contractor shall obtain approved certification, from the manufacturer**, that the product complies with the specification and submit this certification to the Engineer.

All paints shall be delivered at the site in sealed containers marked in accordance with the requirements of SANS 731-1 and -2.

(i)Road marking paint (solvent borne and water borne)

Road marking paint shall be Type 1 as specified in SANS 731-1 for solvent borne paints and SANS 731-2 for water borne paints. Only paint, manufactured in a SANS approved and accredited facility shall be accepted.

A11.7.5 MATREIALS

a) Marking Materials .(continue)

(ii) Retro-reflective road marking

•Retro-reflective road marking paint shall comply with the requirements of road marking paint in A11.7.5.2a)(i) above with retro reflective drop on beads complying with SANS 51423 .

•Determination of coefficient of retro-reflected luminance by means of portable retro-reflectometer shall be carried out using SANS 6261.

(iii) Thermoplastic road marking material

•Thermoplastic road marking material shall comply with the requirements of EN 1436, and SANS 51423 for drop-on glass beads for road marking and anti-skid aggregates and mixtures thereof. Blending of thermoplastic road marking material and glass beads shall comply with SANS 51424.

•The binder shall be a plasticised synthetic resin and the **material shall be reflectorised by mixing in a minimum of 20 % by mass Class A glass beads** in accordance with SANS 51424. **An additional topping of drop on glass beads shall be applied to the hot surface of the material for immediate retro-reflectivity.**

A11.7.5 MATREIALS

a) Marking Materials .(continue)

The white road marking material shall contain 6,0 % by mass minimum titanium dioxide content and shall have a **skid resistance of 45 S.R.T**. – units or higher. **SABS Method 1248 shall be used for determination of traffic wear index; indication of durability**.

The following minimum **lumination values are required** for the completed road marking **for performance-based application**:

- 250mcd/m^2.lux and 120mcd/m^2/lux for white & yellow lines respectively, at 30 days after application.
- 200mcd/m^2.lux and 100mcd/m^2/lux for white & yellow lines respectively, at 6 months after application.

Determination of coefficient of retro-reflected luminance by means of portable retro-reflectometer shall be carried out using SANS 6261

(iv) Methyl Methacrylate (MMA) Cold Plastic Marking Material

Screed applied cold plastic road marking material shall be used for symbols, arrows and letters (hand painted markings) when specified by the Engineer and shall consist of a solvent-free two component reactive acrylic resin, stuffing, beads and pigment to which a hardener shall be added. Application is carried out using a trowel, screed box or an appropriate roller.

A11.7.5 MATREIALS

a) Marking Materials .(continue)

***(iv) Methyl Methacrylate (MMA) Cold Plastic Marking Material* (continue)**

Cold plastic road marking material shall be reflectorised by mixing in a minimum of 20 % by mass (or 400g/m^2) Class A glass beads in accordance with SANS 51424. An additional topping of glass beads shall be applied to the wet surface of the material after application and shall comply with EN 1423

(v) Drop on retro-reflective beads

Retro-reflective glass drop on beads shall be applied to the road marking material before the material dries, cools down or sets.

The beads shall comply with Class A beads in accordance with EN 1424 and SANS 51424. **The beads shall be delivered to site <u>in sealed bags</u>**, marked with the name of the manufacturer and the batch identification number. The Contractor shall, at all times, be in possession of a SANS certificate on site certifying that the beads .

(vi) Pre-Formed Road Marking Tape

A pre-formed, conformable polymer layer made from high quality polymeric materials, pigments and glass beads, designed to be used as an inlay marking on hot asphalt or as an overlay application on concrete and asphalt surfaces.

A11.7.5 MATREIALS

b) Road studs

Road studs, excluding solar powered road studs, shall comply with the requirements of SANS 1442 or SANS 1463-1 and -2 as required. Unless otherwise stated in the Contract Documentation, all road studs shall be bi-directionally reflective; or omnidirectional reflective for circular glass road studs.

•Road studs shall be of the size and classification, or type specified, based on the drawings in the Contract Documentation. **The Contractor shall, after receiving confirmation of the classification or type and number to be installed from the Engineer, submit to the Engineer samples of the type of road studs he proposes to supply for approval**. **The manufactures' specifications, warranty (if any) installation requirements, forming holes for anchors and adhesive requirements shall be provided.**

Road studs shall be supplied and installed in accordance with **the areas of application set out in Table A11.7.5-1 with reference to SANS 1463**.

Road stud type and use is classified for the following areas of application:

Road Stud Application 1 (RSA-1): **High trafficked center line of narrow roads** less than 3,5 m lane width, on single carriageway roads, where paved shoulder width is wider than 1,5 m.

A11.7.5 MATREIALS

b) Road studs (continue)

• **Road Stud Application 2 (RSA-2): Low to high trafficked centre line application on single carriageway roads**, and undivided dual carriageway . All painted island and lane dividing lines at intersections.

•**Road Stud Application 3 (RSA-3)**: **High trafficked lane dividing lines on divided and undivided dual carriageways (2 or more lanes in each direction**).

•**Road Stud Application T (RSA-T**): **All temporary deviations and temporary demarcation.**

In special circumstances **at higher risk locations, solar powered illuminated road studs, of specified colour, shall be installed on instruction of the Engineer**. The Contractor shall, after receiving confirmation of the type and number to be installed from the Engineer, submit to the Engineer samples of the type of solar powered road studs he proposes to supply for approval. **The manufactures' specifications, warranty, installation requirements, and adhesive requirements shall be provided. Solar powered road studs shall be installed midway between retro reflective road studs or as per the drawings.**

A11.7.5 MATREIALS

b) Road studs (continue)

Solar powered road studs shall conform to the following requirements

- The body of the unit shall be of either UV resistant PVC or aluminium with a shank
- Maximum dimensions are 100 x 100 mm or 100 mm diameter, with an installed maximum height of 22 mm
- **The solar panel, electronics and optics shall be sealed inside the unit which shall be waterproof (minimum IP67**)
- A suitable power storage battery or capacitor must be incorporated
- **Battery life to be 3 years**
- **The unit must be capable of operating for a minimum of 36 hours continuously after a charge time of 8 hours**
- Each unit must be provided with super bright LEDs (18 milli candelas per LED) (number and colour per unit to be as specified in the Contract Documentation and/or the Schedule of Quantities)
- Operating temperature range -20°C to 60°C
- **Compression resistance of unit to be between 200-300 kN**
- The spacing of the road studs will be determined by the road geometry, at least 3-4 road studs should be visible at a time

A11.7.6 CONSTRUCTION EQUIPMENT

A11.7.6.1 Mechanical equipment for painting

The mechanical road marking machine shall be **capable of painting at least three lines simultaneously** and shall apply the paint to a **uniform film thickness at the rates of application specified hereinafter ,** painting the road markings to a **uniform width with edges and position within the tolerances specified** and **applying the glass beads simultaneously with painting**.

The machine shall further be **capable of painting lines of different widths by adjusting the spray jets on the machine**. **Fitted with a device to guide the operator to the centre of the line to be painted**.

The machine shall be **capable or spraying at a speed of more than 5,0 km/h and shall be provided with clearly visible amber warning flashing lights, which shall always be in operation when the machine is on the road**.

The machine shall always be operated in the same direction as the traffic flow when applying lane markings under traffic ***with proper traffic accommodation*****.**

A11.7.6.2 Thermoplastic heating equipment

Equipment for heating of thermoplastic material shall be so regulated as not to cause heat damage to the thermoplastic material by **overheating .**

A11.7.7 EXECUTION OF THEWORKS

A11.7.7.1 Surface preparation

Final road marking shall be applied to newly surfaced bituminous surfaces only after a minimum of 15 days, or such longer period specified due to climatic conditions, has elapsed, to ensure that no damage or discolouration is caused by volatiles evaporating from the surfacing. However, **where the road is to be opened to traffic before this condition is met, temporary lines shall be painted using water borne road marking paint in the position of the future final lines**.

Before the road marking is applied, the surface shall be clean and dry and completely free from any soil, grease, oil, acid or any other material, which will be detrimental to the bond between the paint and the surface. The onus is on the Contractor to ensure that surface is sufficiently clean and dry to ensure that the quality of the road markings will not be adversely affected.

The Contractor is also responsible for protecting road studs from being painted over, and the subsequent cleaning thereof if such over-painting should occur. Cleaning of road studs shall be done in such a manner that the functionality of the road studs will not be detrimentally affected by the cleaning agent used.

A11.7.7 EXECUTION OF THEWORKS

A11.7.7.1 Surface preparation (continue)

Where **road markings are to be applied to a concrete pavement**, **all laitance** and **loose curing compound shall be removed**. Concrete primers may be recommended for specific road marking paints which will require curing times.

Particular care shall be taken to ensure that the surface shall be clean, fresh concrete on all areas where road studs are to be fixed.

No additional payment for cleaning and preparation of the road surface for road marking will be made, and such cleaning and preparation shall be deemed to be **included in the rates for road marking items.**

A11.7.7.2 Setting out the road markings

Where road markings are to be replaced after any construction activity, all existing road markings shall be accurately surveyed and referenced before commencement of any such construction activity which may obliterate the existing road markings.

The position of barrier lines shall be re-assessed on site by the Engineer before the Contractor commences with the road marking. The dimensions and positions of road markings shall be as shown on the drawings .

A11.7.7 EXECUTION OF THEWORKS

A11.7.7.2 Setting out the road marking (continue)

The lines, symbols, figures or marks shall be **premarked by means of paint spots of the same colour as that of the final lines and marks**. These paint spots shall be not more than 1,5 m apart. Normally spots of approximately 10 mm in diameter should be sufficient.

After spotting, the positions of the proposed road markings such as broken lines and the starting and finishing points of barrier lines shall be indicated on the road. The positions and outlines of special markings shall be produced on the finished road in chalk **These premarkings shall be approved by the Engineer prior to any painting operations being commenced**.

.The **position of road studs shall be marked out** on the road and shall be approved by the Engineer before they are fixed in position

A11.7.7.3 Applying the markings

The Contractor's establishment on site and general obligation shall be deemed to fully include the establishment of the road marking team, irrespective of the number of times the road marking team is required to be on site or is required to move within the site or whether markings are temporary or final.

A11.7.7 EXECUTION OF THEWORKS

A11.7.7.3 Applying the markings (continue)

Where the marking is applied by machine, it shall be applied in one layer and operation. **Before the road marking machine is used on the permanent works, the satisfactory operation of the machine shall be demonstrated on a suitable site**, **which is not part of the permanent works.** Only when the machine has been correctly adjusted (application rates) and its use has been approved by the Engineer, may the machine be used on the permanent work. **The operator shall be experienced in the use of the machine**.

Where two or three lines are required next to each other, the lines shall be applied simultaneously by the same machine.

Where, under special circumstances, **painting is done by hand, it shall be applied in two layers, and the second layer shall not be applied before the first layer has dried out sufficiently**. As most road marking paint reacts with the bitumen surface of newly surfaced roads, the paint shall be applied with one stroke only of the brush or roller.

If **in the opinion of the Engineer, conditions are unsafe, the centre-line shall be painted immediately as temporary road marking after 2,0 km of continuous road has received a new asphalt layer, or 4,0 km of continuous road has received a new seal surfacing**

A11.7.7 EXECUTION OF THEWORKS

A11.7.7.3 Applying the markings (continue)

Solvent and water borne road marking paint shall be applied at a nominal rate of 0,42 ℓ/m²; or as specified as the recommended application rate by the paint manufacturer, (**nonperformance based**).

Spray thermoplastic road marking shall be applied at a nominal rate of 2,5 kg/m² to achieve a minimum thickness of 1,25 mm to 1,5 mm; (**nonperformance based**).

Screeded cold plastic road marking shall be applied hand by means of a trowel, screed box or an appropriate roller at a nominal spreading rate of 4,5 kg/m² to achieve an estimated 2,0 mm material thickness. The desired symbol or line shall be marked with a tape or a template on the road surface.

In order to ensure proper coverage on all types of surfaces the Engineer may order an increase in the above nominal application rates. Payment for these variations in application rates shall be made under items for variation.

A **daily log-sheet**, in a format approved by the Engineer, shall be completed and signed by the Contractor and the Engineers representative, **recording the quantities of paint and glass beads used on that day and shall be available for inspection at all times.**

A11.7.7 EXECUTION OF THE WORKS

A11.7.7.4 Applying the retro-reflective beads

The retro-reflective beads shall be sprayed by means of a suitable machine in one continuous operation, immediately after the paint has been applied. The rate of **application of the beads shall be 400 g/m^{2}or such other rate as may be specified**. **Machines which apply the beads by means of gravity only shall not be used.** .

Where letter, symbol, traverse line and island road marking is undertaken by hand, the glass beads may be applied by hand. Prior to any hand application work, the Contractor shall first request approval from the Engineer.

Beads shall be applied in accordance with SANS 51423 and SANS 51424.

A11.7.7.5 Installation of road studs

Road studs shall be of the type specified and/or indicated on the drawings. Where anchored or embedded road studs are specified the making of anchor holes or embedment holes shall be made in accordance with the manufacturer's specifications .

A11.7.7 EXECUTION OF THE WORKS

A11.7.7.5 Installation of road studs (continue)

The road studs **shall be fixed by means of an approved epoxy resin** or other specified adhesive in accordance with the manufacturer's Instructions. Different adhesives shall be used in winter and summer as per the manufacturers' specifications. **The studs shall be protected against impact until the adhesive has hardened.** With second slurry of a Cape Seal or a texture treated road surface, **the risk of delaminating of the upper slurry shall be assessed prior to using surface bonded road studs**.

Permanent road studs shall be fixed after the road marking of the road. The Contractor shall replace at his own cost any road studs that have been damaged by constructional activities or that have been stained and cannot be cleaned entirely. **Where specified by the Engineer, the Contractor shall remove the existing road studs prior to the application of the surfacing seal**.

Where specified by the Engineer, temporary road studs shall be installed. The Contractor shall maintain the temporary road studs in position until the final road markings have been completed.

Not more than 5 % loss of road studs during the Defects Notification Period (where applicable) will be accepted.

A11.7.7 EXECUTION OF THE WORKS

A11.7.7.6 Protection

After the road marking has been applied, the markings shall be protected against damage by traffic or other causes. The Contractor shall be responsible for erecting, placing and removing all warning boards, flags, cones, barricades and other protective measures which may be necessary in terms of any statutory provisions and/or as may be recommended in the SADC and South African Road Traffic Signs Manual.

A11.7.7.7 Weather limitations

Road marking or road studs shall not be applied to a damp road surface or at temperatures lower than 10°C or when in the opinion or the Engineer, the wind strength is such that it may adversely affect the painting operations

A11.7.7.8 General .Were indicated by the Engineer, the Contractor shall remove existing painted markings from the existing surfaces by means of sand blasting. Suitable precautions shall be taken to avoid damage to nearby vehicles or other property during the sand blasting process.

The use of black paint or chemical paint remover to obliterate existing markings will not be permitted, except where it is specified by the Engineer as a temporary measure. Where black paint is used, it shall be matt.

A11.7.8 WORKMANSHIP

A11.7.8.1 Faulty workmanship or materials

In order to **monitor the application of paint film thickness and application of glass beads** the following control mechanisms shall be employed **for all non-performance-based** road marking:

- At the start of this work, **all paint and bead containers shall be recorded** and marked together by the Contractor and Engineer and on completion of the work, all empty containers shall again be recorded, which measures shall be used for calculating the application rates.
- **At regular intervals, plates shall be placed in the line** of marking and be painted over in order to **calculate the paint thickness and bead application**.
- On extended sections of road marking, the **spray machines shall be dipped for volume determination at the start and end or each run**, as well as recording the start and end measures of beads. In addition, a discrete marking shall be made at each start and end position in order to determine the area painted.
- A comprehensive record shall be kept of all the measurements and submitted to the Engineer on a daily basis.

A11.7.8 WORKMANSHIP

A11.7.8.2 Tolerances

Road markings shall be constructed to accuracy within the tolerances given below:

a)Width - shall not be less than the specified width, nor shall they exceed the specified **width by more than 10 mm.**

b)Position- shall not deviate from the true position by **more than 100 mm in the longitudinal and 20 mm in the transverse direction.**

c)Alignment of markings - the edges of longitudinal lines shall **not deviate from the true alignment by more than 10 mm in 15 m.**

When existing lines are repainted, the new markings shall **not deviate more than 100 mm in the longitudinal direction nor 10 mm in the transverse direction** from the existing marking.

The alignment of the **road studs shall not deviate from the true alignment by more than 10 mm and shall be positioned so that the reflective faces are within 5° of a right angle to the centre line of the road .**

A11.7.8 WORKMANSHIP

A11.7.8.2 Tolerances (continue)

d) Broken lines - length of segments of broken longitudinal lines shall not deviate by more than 150 mm from the specified length.

e) Testing of plant and equipment

Before applying any final road markings, the Contractor shall satisfy himself and the Engineer, by painting test lines on a section of pavement other than the section required to be marked:

•that the **painting machine is in good working order**

•that **the operator is fully experienced**; and

•that **the machine sprays at the specified rate of paint application**.

The Contractor shall bear the cost of all materials and workmanship required for the above plant tests.

While work is in progress, tests shall be carried out on materials and/or the quality of work to ensure compliance with the specified requirements. The sampling methods are specified in SANS 731-1. The sampling methods described in TMH5 shall be followed where applicable.

B11.7 ROAD MARKING AND ROAD STUDS

B11.7.6 CONSTRUCTION EQUIPMENT

On certain low order roads and within urban areas, the Engineer may authorise labour enhanced road marking by means of handheld or pushed equipment using rollers or brushes of the required width or by mobile hand operated pressure applied road marking equipment.

B11.7.7 EXECUTION OF THE WORKS

Where **road marking or the painting of kerbs by hand is authorised**, the Contractor shall **demonstrate by means of trial sections that the methods employed will meet all the required specifications**, application rates and tolerances and will be maintained during the work execution.

The Contractor may select the type and make of hand operated line marking equipment subject to executing trial sections to verify to the Engineer that all the required specifications, application rates and tolerances are achieved and will be maintained during the work execution.

QUESTIONS

11.8 LANDSCAPING AND PLANTING PLANTS

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A11.8 LANDSCAPING AND PLANTING PLANTS

A11.8.1 SCOPE

This Section includes **all areas affected by construction activities** but may also extend to other areas requiring **landscaping and planting for functional or aesthetic purposes**. **It includes landscaping, grassing, rehabilitation, erosion protections and planting trees and shrubs.**

The conservation of vegetation /temporary nursery delt with under Clearing and Grubbing (item C1.6.8)

A11.8.5 MATERIALS

A11.8.5.2 MATERIALS

a) Topsoil

Topsoil, as defined in Clause A1.6.2 of Chapter 1, shall be **obtained from stockpiles and/or windrows** of topsoil which have been prepared as specified in Clause A1.6.7.6 of Chapter 1.

Where so specified, the Contractor shall procure and furnish **topsoil from commercial sources** outside the site, after such sources have been approved by the Engineer.

b) Fertiliser/soil-improvement material

One or more of the following types or any other type of fertiliser/soil-improvement material specified in the Contract Documentation:

- **Soil-improvement materials** such as **dolomitic lime, basic slag, gypsum, superphosphate and agricultural lime, compost, manure and mulches**.
- **Fertilisers such as limestone ammonium nitrate, 2:3:2 (22) and 3:2:1 (25**).

A11.8.5 MATERIALS

A11.8.5.2 MATERIALS

c) Grass cuttings

Grass cuttings shall be **fresh cuttings** of an approved type **of grass with sufficient root material to ensure good growth.**

d) Grass seeds

Only **fresh certified seed** shall be used and the types of seeds in the seed mixture shall be as **specified in the Contract Documentation**.

Mixing the various types of grass seeds for obtaining the prescribed grass-seed mixture shall be done on the site in the presence of the Engineer. Storing and identifying the grass seeds and the grass-seed mixtures on the site shall be the responsibility of the Contractor.

The **grass seed mixture, where required, shall be indigenous to the local area** as specified in the Contract Documentation

e) Trees and shrubs(indigenous)

Plants shall be of the variety and size shown on the drawings or in the Contract Documentation and/or the schedule of quantities.

A11.8.5 MATERIALS

A11.8.5.2 MATERIALS

e) Trees and shrubs (continue)

The Contractor shall supply plants which are healthy, shapely, well rooted and disease-free. **Plants must be hardened and be exposed to direct sunlight for at least six months prior to planting in the road reserve**. **A minimum amount of water/fertiliser should be administered in order to acclimatise the plants for their future environment .(succulents)**

f) Grass sods (new number)

Grass sods shall be either nursery-grown or veld sods .The sods shall be **free from weeds and diseases**. Sods delivered to the site shall be moist and shall **have at least 30 mm soil thickness for nursery-grown sods and 50 mm soil thickness for veld sods, at the location of planting or placement**. Sods shall also measure a minimum of 400 mm in width and 500 mm in length and shall retain the minimum dimensions once placed for planting and **free of weeds** .

- **Nursery-grown sods**

These sods shall be of the variety of grass specified in the Contract Documentation. **The grass shall have been grown specifically for sod purposes, mown regularly** and cared for to provide an approved uniformity .

A11.8.5 MATERIALS

A11.8.5.2 MATERIALS

f) Grass sods (new number)(continue)

- **Veld sods**

These sods may be **obtained from commercial or near the site where a suitable type and density of grass and type of soil are found**.

g)~~f~~) Anti-erosion materials(renumber)

Anti-erosion compounds or hydraulic mulches shall consist of an organic or inorganic material to bind soil particles together or form a growth medium and shall be a proven product able to suppress dust and to form a protective encrustation. The application rate shall conform to the manufacturer's recommendations.

h)~~g~~) Manure (renumber)

Manure shall be old sweated, pure kraal manure free from soil, noxious weed seeds or other undesirable material. It shall not contain any particles that will not pass through a 50 mm screen and shall be approved by the Engineer before being delivered to the site.

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A11.8.5 MATERIALS

A11.8.5.2 MATERIALS

i)~~h)~~Compost (renumber)

Compost **shall be well decayed, friable and free from noxious weed seeds or any other undesirable materials**. It shall **not contain any particles that will not pass through a 50 mm screen** and shall be approved by the Engineer prior to delivery on the site.

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A11.8.7 EXECUTION OF THE WORKS

A118.7.1 Landscaping the areas

a) Shaping

Areas within the road reserve but outside the road prism which require shaping by means of bulk earthworks such as contoured areas at interchanges, intersections and rest areas which require earthworks shall be excavated, filled and compacted Such work shall be regarded as being earthworks and measurement and **payment therefore shall be made under Chapter 5.**

b) Trimming

The existing or **previously shaped ground to an even surface** with the final levels generally following the original surface, and it is a requirement that the drainage remains effective without ponding. Trimming shall **normally be done by grader, or steep areas by bulldozer**. If specified and where machine operations are not practicable, **because of confined spaces or steep slopes, trimming shall be done with hand tool**. **When trimming is done on slopes, the ridges shall be made parallel to the contour.**

Trimmed surfaces shall be left slightly rough to facilitate a better binding with topsoil or the natural establishing of vegetation.

A11.8.7 EXECUTION OF THE WORKS

A118.7.1 Landscaping the areas

c) Construction plant rates

The Engineer shall be entitled **to pay for shaping and trimming on the basis of hourly construction plant rates. Any labour or other plant required shall be paid for on hourly or daily rates.**

A11.8.7.2 Preparing the areas for planting

a) Soil ripping and scarifying

Where soil is too hard to be scarified with a light tractor, the soil shall be ripped up to a depth of 300 mm before it is loosened by scarifying to a depth of 150 mm.

b) Areas which do not require topsoil

Where the areas to be grassed consist of organically suitable material, the topsoil shall be loosened by scarifying to a minimum depth of 150 mm. **All loose surface stones exceeding 20 mm in size on areas to be mowed by machine and falling within the road reserve and all surface stones exceeding 50 mm in size in other areas shall be removed.**

A11.8.7 EXECUTION OF THE WORKS

A11.8.7.2 Preparing the areas for planting (continue)

c)Areas which require topsoil

Where areas to be grassed consist of organically unsuitable material, the surface shall be scarified to a minimum depth of 150 mm before topsoil is placed and trimmed to the uniform thickness to ensure a proper bond between the topsoil and the subsoil.

The topsoil can also be scarified by means of handraking or light rotavators and all stones removed as specified for areas not requiring topsoil .

d) Fertilising

All areas to be planted, and on instruction of the Engineer, the Contractor shall have the **top 150 mm of the prepared surface including the topsoil applied analysed to determine the quantity and type of fertiliser which may be required for establishing proper growth conditions for the grass or to assess the requirement for any soil improvement required. The Engineer shall be furnished with the soli-analysis and subsequent fertiliser recommendation**.

Soil-Improvement materials (such as lime, superphosphate, etc) shall be evenly applied over all surfaces where soil improvement is required .

A11.8.7 EXECUTION OF THE WORKS

A11.8.7.2 Preparing the areas for planting (continue)

f) General

After an area has been prepared for grassing, the seeding or grassing shall be completed before crustificatlon takes place. Where a crust has been formed before seeding or grassing is done, the Contractor shall, at his own cost, loosen the crust by scarifying to a depth of 50 mm.

g) Removal of undesirable vegetation

During the course of the contract **the Engineer may instruct the Contractor to physically remove undesirable vegetation from within the road reserve**. Such an operation shall take place **before the flowering stage of the undesirable vegetation** upon written instruction from the Engineer . **Should the Contractor fail to respond to the written instruction from the Engineer for the removal of the aforementioned undesirable vegetation before flowering, the Contractor shall be held contractually responsible for any growth or seeding of said vegetation for a period of not less than twelve (12) months in the affected area.**

A11.8.7 EXECUTION OF THE WORKS

A11.8.7.3 Grassing

a) Planting grass cuttings

The **areas to be grassed by means of grass cuttings shall, unless already moist, be thoroughly watered** before the cuttings are planted to ensure that the soil will be uniformly moist to a depth of at least 150 mm when the planting is done.

Only **fresh cuttings shall be used but not any grass cuttings that have been allowed to dry out**. Immediately after having been planted, the grass cuttings shall be given a copious watering.

b) Sodding

Areas to be grassed by sodding shall be given a layer of topsoil of at least 50 mm in thickness unless, where suitable soil is present. **The areas to be sodded shall be thoroughly watered** beforehand so that it will be moist to a depth of at least 150 mm during sodding. Sods shall be protected against drying out and kept moist from the time of harvesting until they are finally placed. **The handling of the sods shall not result in the sods losing their prescribed soil thickness**.

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.3 Grassing

b) <u>Sodding</u> (continue)

On a slope, **laying the sods shall start at the bottom of the slope**. The sods shall be butted tightly against each other, and care shall be taken not to stretch or overlap the sods.

On steep **slopes the sods shall be held in position by a sufficient number of wooden stakes approximately 300 mm long by 20 mm in thickness and these stakes shall be knocked into a depth of 100 mm into the subsoil**.

Sods laid **adjacent to concrete side drains shall be laid in such a manner that the sodding will be 20 mm higher than the concrete**. **The top surface of sods laid adjacent to the road pavement shall be 50 mm lower than the road surface. When strip sodding is required, the sods shall be laid in such a manner that the sods are proud of the surrounding ground level**

As sodding is **completed each section shall be lightly rolled or firmly pressed to ensure a proper bond with the underlying material, and thoroughly watered** afterwards .

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.3 Grassing

c) Hydroseeding

The **types and mixtures of seeds to be used shall be as specified in the Contract Documentation**. Mulch shall be added to the hydroseeding mix at an approved rate.Hydroseeding shall then be **carried out with an approved hydroseeding machine** at a rate of application of not less than 38 kg of seed mixture per hectare, unless otherwise specified in the Contract Documentation

When the use of anti-erosion compounds is required, and such compound is to be applied simultaneously with the hydroseeding.

d) Topsoiling only

Where, the **planting of grass or hydroseeding can be dispensed with on account of favourable climatic and other conditions**, **the Contractor may attempt to establish grass by topsoiling only**. Topsoil shall be selected for the presence of natural grass and seeds.

e) Grassing with an approved grass planter

Grassing shall be done with an **approved grass planter which plants the seeds in rows spaced not more than 2,5 mm apart.** The planter shall plant the seeds approximately 6,0 mm deep and shall lightly compact the soil.

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.3 Grassing

f) Sowing by hand

Particularly on areas inaccessible to machines ,the top 20 mm of prepared topsoil shall be raked away in sections, the seed shall then be spread uniformly within the prepared area. The top 20 mm topsoil shall then be raked over the seedbed, ensuring an even thickness.

The types and mixtures of seeds to be used shall be as specified in the Contract Documentation. The Contractor shall be solely responsible for establishing an acceptable grass cover.

g) Other methods of grassing

Other specific methods of grassing may be included under this section in the Contract Documentation.

h) The grassing of borrow pits, temporary deviations, camp sites, access roads and stockpile sites

Prior to any grassing that may be required on such areas, the finishing-off of borrow pits, obliterating the temporary deviations and access roads, and the clearing of camp sites as described under the relevant Chapters, shall have been carried out as specified in the relevant sections.

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.4 Maintaining the grass cover

a) Watering, weeding, mowing and replanting

All **sodded and grassed areas shall be adequately watered at regular and frequent Intervals to ensure the proper germination of seeds and growth of grass** until the grass has established an acceptable cover and thereafter until the beginning of the maintenance period of the grass.

b) Acceptable cover

Acceptable grass cover **shall mean that not less than 75 % of the area grassed or hydroseeded shall be covered with grass** and that no bare patches exceeding one quarter in any area of 1,0 m x 1,0 m shall occur. **In the case of sodding**, acceptable cover shall mean that **the entire area shall be covered with live grass at the end of any period not less than three months after sodding**.

c) Maintenance period

A maintenance period in respect of grass shall commence when an acceptable grass cover has been certified by the Engineer to have been established and shall extend for the duration of the contract. During the maintenance period, the Contractor shall be responsible for damage to grass cover due to his own activities as well as for weeding the vegetated areas.

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.5 Trees and shrubs

a) Positions of trees and shrubs

- Plants in the median shall be planted in a line 1,5 m from the centre line of the median. Generally, **only shrubs shall be planted in medians**.
- When **the carriageways are at different levels, the plants in the median shall be planted 3,0 m from the edge of the pavement on the high side of the median or as directed by the Engineer.**
- Where **the road curves, the plants in the median shall be planted on the inside of the median centre line**.
- Where the carriageways are at different levels as well as on a curve, the plants in the median shall be planted on the high side, provided they **do not impede on sight distance, or as directed by the Engineer.**
- At freeway crossings over roads or rivers, shrubs shall be planted in the positions shown on the drawings.
- **Care shall be taken not to obscure traffic signs by plants**.
- Trees shall **not be planted closer than 10 m from the yellow line on the outside shoulder, or as directed by the Engineer**.

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.5 Trees and shrubs

b) Preparing plant holes

- **All holes shall be square in plan**.

- Holes for **shrubs shall be at least 500 mm square by 600 mm deep** at Intervals of at least 1,5 m centre to centre. Alternatively, a 500 mm wide trench 600 mm deep may be dug, subject to the Engineer's approval.

- Holes **for trees shall be at least 700 mm square by 800 mm deep**.

- The holes for plants shall be refilled with selected and approved topsoil thoroughly mixed beforehand with manure or compost (one 5 ℓ bucket full for every shrub hole and one 10 ℓ bucket full for every tree hole) and, depending on soil-analysis, the required quantity and type of fertiliser. The fill material shall contain an approved water-retaining admixture.

- **The holes shall be thoroughly watered before plants are planted**. Where the soil is poorly drained, 150 mm of crushed stone shall be placed at the bottom of the hole before it is filled with soil.

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.5 Trees and shrubs

c) Planting

Before trees and shrubs are removed from their containers for planting purposes, they shall be watered to the point of saturation. Directly after having been planted, each plant shall be well watered with a view to settling the soil.

All trees shall be tied by means of treated sisal rope to two creosote-treated timber stakes planted firmly in the ground on both sides of the tree directly opposite each other.

After planting, the ground surface around the shrubs shall be covered with straw or grass or other type of mulch to minimise evaporation and/or weed competition.

The ground surface around each tree shall be covered with a plastic membrane with a surface area of 1,0 m^2 and a thickness of 150 micron. Thereafter rocks or stones measuring 150 mm to 250 mm in size shall be placed in a riprap fashion following the contours of the plant hole.

Trees and shrubs shall be considered established once new growth is evident without die-off of portions of the plants, but not less than one month

A11.8.7 EXECUTION OF THE WORKS

A11.8..7.5 Trees and shrubs

d) Maintenance

A maintenance period in respect of trees and shrubs **shall commence when their establishment has been certified by the Engineer and shall extend for the duration of the contract**. During the period of maintenance, the Contractor shall be responsible for damage to plants due to his own activities as well as watering the trees and shrubs when necessary and keeping the plants free from weeds and pests

A11.8.7.6 Alternative slope and erosion protection

Alternative slope and erosion protection methods and materials shall be as specified in the Contract Documentation. **These may include vegetation cylinders or logs attached to slopes, geotextile and organic blankets, topsoil alternatives, etc**.

A11.8.7 EXECUTION OF THE WORKS

A11.8.7.7 General

a) Time for planting

Grass, trees and shrubs shall be planted as far as is practicable during periods of the year most likely to produce best growing results or dependent on the germination requirements of the seed mixture. The Contractor shall make every effort to programme his operations in such a manner that grass, trees and shrubs shall, as far as is possible, be planted during this period.

b)Traffic on grassed areas

The Contractor shall not plant any grass until all operations which may require road-building equipment to be taken over grassed areas have been complete. All damaged areas shall be reinstated by the Contractor at his own expense.

c) Erosion prevention

During construction the **Contractor shall protect all areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible** and by taking such other measures as may be necessary **to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas**.

A11.8.7 EXECUTION OF THE WORKS

A11.8.7.7 General

d) Proprietary brand materials used for erosion prevention

Certain proprietary brands of materials which may be necessary for erosion prevention to enable natural grass to become established shall, if required, be specified in the Contract Documentation.

e) Responsibility for establishing an acceptable cover

The Contractor shall be solely responsible for establishing an acceptable grass cover and for the cost of replanting grass or rehydroseeding where no acceptable cover has been established. Where however, in the opinion of the **Contractor it is doubtful from the outset** if it will be possible to establish an acceptable **cover he may inform the Engineer of his reasons therefore**, and the Engineer may, if he agrees, **either adopt another method of grassing or agree to accept whatever cover can be obtained**, provided that all reasonable efforts shall be made to establish a good grass cover by the proposed method. Any such agreement shall be valid only if given in writing by the Engineer before

f) Refertilising

Should it become necessary, the Engineer may instruct the Contractor to undertake a refertilising programme on grassed areas during the defect's liability period.

A11.8.7 EXECUTION OF THE WORKS

A11.8.7.7 General (continue)

g) Weeding

The Contractor shall maintain all areas affected by construction activities free of all weeds/alien plants . They shall be removed before the seeding stage of each species. **Should the Contractor fail to remove the alien plant species before seeding he shall be held responsible for weed removal within the affected area, for an additional period of one year, over and above the contractual one-year defects liability period**.

The method for the **removal of weeds shall be either by hand, which shall include the removal of the complete root system, or by chemical means**, through the use of a registered selective herbicide. **Only a registered, licensed pest control operator, licensed for the industrial application of herbicides, shall administer the application of herbicides.**

h) Establishment of vegetation within areas disturbed by construction activities

The Engineer shall assess any area within the construction boundaries that has been disturbed by construction activities, but which is not scheduled remain the Contractor's responsibility for formal revegetation within the contract. These disturbed areas, nonetheless, responsibility for the removal of alien vegetation

QUESTIONS

11.9 FINISHING THE ROAD AND ROAD RESERVE AND TREATING OLD ROADS

11.9 FINISHING THE ROAD AND ROAD RESERVE AND TREATING OLD ROADS

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A11.9 FINISHING THE ROAD AND ROAD RESERVE AND TREATING OLD ROADS

A 11.9.1 SCOPE

This Section **covers the final finishing and cleaning up of the road and road reserve and all associated works on the site at the completion of construction**, including scarifying and treating old roads, temporary deviations and other temporary works.

•Construction may be as new construction, as renewal construction or as a combination of both. When construction includes elements under Section A1.6 of Chapter 1: Clearing and Grubbing, Chapter 4: Borrow Materials, and Mass Earthworks; and Section A11.8 of Chapter 11: Landscaping and planting plants, then this Section does not cover the required finishing under those Chapters and Sections.

A11.9.6 CONSTRUCTION EQUIPMENT

The Contractor shall submit his plant and equipment list for the finishing and cleaning, disposal, stockpiling if specified, loading and hauling as part of his method statement to perform the different elements of the Works

A11.9.7 EXECUTION OF THE WORKS

A11.9.7.1 Finishing the road and road reserve

- For **new construction**, after completing the seal, surfacing or gravel surfacing on gravel roads; or other final activities where surfacing is not included, the **road and road reserve shall be cleared of all excess earth, stones, boulders, debris, litter, garbage, unwanted vegetation and other waste or excess material resulting from the construction of the works or the use of the road**. **All finishing and cleaning not previously done or required as specified in the sections of the specifications set out in Clause A11.9.1 above, shall be undertaken and completed**.
- **This specification, however, does not intend the finishing, cleaning and maintenance, which must be undertaken as provided for in other Sections of these specifications, to be postponed until the final finishing operations provided for in this section**.

A11.9.7 EXECUTION OF THE WORKS

A11.9.7.1 Finishing the road and road reserve

- For **renewal construction (rehabilitation)** after completing construction work within the site, the Contractor shall ensure that all construction generated or related material that may have been swept, windrowed, stockpiled, stored or spread beyond the road surface is removed. Should, during the removal of construction generated or related material, existing vegetation or topsoil be disturbed or destroyed, the Contractor shall, at his own cost, re-instate the road reserve to its original state. This shall include ripping, should the construction material and processes have compacted the original surfaces.
- **Culvert inlets and outlets, culvert barrels, and open drains shall be cleared of debris, soil, silt undesirable vegetation and other material generated from the construction activities**.
- The **surfacing shall be cleared** of all dirt, mud and foreign objects. Brooming or other non-damaging actions shall be used on finished surfacing and dragging, pushing or scraping material across surfacing shall not be permitted.

A11.9.7 EXECUTION OF THE WORKS

A11.9.7.1 Finishing the road and road reserve

- All junctions, intersections, islands, kerbing and other elements making up the completed works shall be neatly finished off.
- The Contractor shall ensure that all noxious weeds have been removed from the road reserve and borrow pit areas.
- All materials resulting from the finishing operations shall be disposed of at approved locations, such as approved waste disposal sites or approved disused borrow pits.
- Excess stone in particular from resurfacing operations shall be collected and removed from the site to ensure that future grass cutting maintenance work will not be hindered by remaining surfacing stone. The Contractor shall make his own arrangements with the owners of properties on which such materials are to be deposited.
- Disused materials such as pipe culverts, not further required and left with approval on adjoining properties, shall be disposed of out of sight from the road to ensure the road appearance reflects a fully complete and finished project.

A11.9.7 EXECUTION OF THE WORKS

A11.9.7.2 Treating old roads

All **old roads, temporary deviations, haul roads and construction roads** shall, in so far as is practicable, are levelled with the original ground. Surfaces shall be scarified and broken up to a depth of 150 mm for promoting plant growth.

Where specified by the Engineer, in order to prevent soil erosion, banks, dykes or ditches shall be constructed over the old road to dimensions specified by the Engineer.

All roads and temporary deviations treated as above shall be left in a neat and tidy state.

QUESTIONS