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| <br><b>RAND WATER</b> | <b>RAND WATER<br/>QUALITY MANAGEMENT SYSTEM<br/>PROCEDURE / GUIDELINE</b>     |  |
| <b>TITLE: RAND WATER ROADS STANDARD<br/>SPECIFICATIONS</b>   | <b>DOC NO: (SAM DOC 0000X SPEC)</b>   |  |
| <b>SECTION: DESIGN<br/>OFFICE - CIVIL</b>  | <b>EFFECTIVE DATE: MAY 2024</b>   | <b>REV. NO: 01</b>   |
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## 1. PURPOSE

This document provides the minimum standards, guidelines and specifications for roads being designed and constructed for and on behalf of Rand Water.

## 2. SCOPE

This document provides the functional specifications for Rand Water Roads projects.

## 3. APPLICABILITY

This document is applicable to all road's projects undertaken for Rand Water. It applies to all projects within and outside Rand Water stations.

## 4. REFERENCES

The following standards are referenced:

| Document Title  | Document No.               | Location         |
|---|----------------------------|------------------|
| South African National Standards  | Various SANS standards     | Library/Intranet |
| "Guideline for Human Settlement, Planning and Design" (Red Book), published by the Building and Construction Technology Division of the CSIR. | Red Book - Volumes 1 and 2 | RW Library       |
| South African Bureau of Standard – Standard Specification for Civil Engineering Construction.   | SANS1200                   | Library/Intranet |
| TRH4 – Structural Design of Flexible Pavement for Interurban and Rural Roads.   | TRH4                       | RW Library       |
| UTG2 - Structural Design of Segmented Block Pavement for Southern Africa.   | UTG2                       | RW Library       |
| The South African National Roads Agency Limited – Drainage Manual   | SANRAL Drainage Manual     | RW Library       |
| COTO – Committee of transport officials   | COTO                       | RW Library       |
| Specifications for Road and Bridge Works for South African Road Authorities   |                            |                  |
| Quality Management System Requirements  | ISO 90001                  | SHREQ Office     |
| Environmental Management System Requirements  | ISO 14001                  | SHREQ Office     |
| Occupational Health & Safety Act and Regulations  | OHS ACT                    | SHREQ Office     |
| Occupational Health & Safety Act Assessment Series  | OHS AS 18001:              | SHREQ Office     |

|  |                 |        |
|--|-----------------|--------|
| Other codes of practice and guidelines Technical specifications, Guidelines for drafting Swedish Standard SIS-055900-1967 SA 2 1/2 | ARP 013 - 1990: |        |
| Rand Water Standard Drawings.  | Various         | RW TIC |

## 5. TERMS, DEFINITIONS AND ABBREVIATIONS

| Term/Abbreviation | Definition   |
|-------------------|--|
| TRH               | Technical Recommendation for Highways                              |
| TMH               | Technical Methods for Highways                                     |
| CBR               | California Bearing Ratio   |
| DCP               | Dynamic Cone Penetrator  |
| AASHTO            | American Association of State Highway and Transportation Officials |
| RW TIC            | Rand Water "Technical Information Centre"                          |
| SANS              | South African National Standards                                   |
| SHREQ             | Safety, Health, Risk, Environmental and Quality                    |

## 6. RESPONSIBILITY AND AUTHORITY

The overall managerial responsibility for the implementation of this specification lies with the Design Office Manager/Lead Civil Design Engineer under the Design office of the Strategic Asset Management Division of Rand Water. The responsibility of implementation of this manual is with the appointed Professional Engineer and Contractor.

## 7. ACTION / PROCEDURE / METHOD

### REQUIRED MINIMUM FUNCTIONAL REQUIREMENTS

- Expected Annual Growth = To be determined
- Required design life of the pavement = 20 years
- Maximum Expected Axle Load = 36 000kg (Max. of 18000kg per axle)
- Maximum Permissible Axle Load = 88kN
- Damage Factor = 2 – 4 (As per TRH4 guideline)
- Allowance to be made for heavy vehicle to use this road during minor construction works.

### MINIMUM DESIGN REQUIREMENTS

- Access road, 5m wide irrespective of road existing reserve width.
- 40km/h design speed

- The surfacing to be block paved, concrete slabs, asphalt or other SABS approved surfacing material.
- Minimum designed stormwater return period shall be for 1:5 years.
- 450mm minimum pipe for stormwater management.

## **ACCESS TO THE SITE**

- Access to site will be from existing local, provincial or national roads. The Contractor will be responsible for obtaining wayleaves from the relevant authorities.

## **GEOMETRIC DESIGN**

Appropriate values must be chosen for the following geometric design parameters, based on the proposed design speed for the road:

- Horizontal curvature
- Gradients
- Vertical curves
- Sight distances
- Design vehicle dimensions, determined by the type of facility being designed

## **CROSS SECTIONAL ELEMENT DIMENSIONS**

Special attention must be given to adequate surface drainage of parking areas. A minimum gradient of 0.5% must be used to avoid ponding of water.

A 2% chamber is required for road cross sections.

In areas / facilities with a high rate of pedestrians, care must be taken to avoid / minimize conflict points between vehicles and pedestrians. Sidewalks and or pedestrian walkways must be provided where required.

When choosing a pavement design for a road or parking area, the following must be considered:

- The design lifetime of the facility.
- The estimated E80 axle loading over the design lifetime.
- Available construction materials
- The macro-climatic region of South Africa in which the facility is to be constructed.
- The prevention of water penetration through the pavement, especially in dolomitic areas.
- The maintenance related to the type of pavement design.
- Life – cycle cost of the pavement, taking into account both initial capital (construction cost) and maintenance costs over the lifetime of the pavement.

## **ROAD CROSS SECTION**

The access road and internal roads shall be designed as 5.0 m wide roads with 1.0 m wide verges on either side of the road. The road structure shall consist of a minimum 3 compacted layers of 150 mm each. V-drains shall be provided where required to affect drainage and the roads must be designed with a similarly effective cross-fall.

## **MATERIALS AND LAYER WORKS**

The layer works design must be completed by:

- Catalogue design
- Rational design/Software design

Materials to comply with the TRH and COTO

## **INTERLOCKING BLOCKS AND CONCRETE PAVING**

- Surfacing with interlocking blocks is generally preferred.
- Surfacing with interlocking blocks should always be used where justified as result of traffic load, where oil and fuel leakage/spillage is likely to occur, e.g. parking areas, filling stations, where tight turning action by heavy vehicles would damage bituminous surfacing, etc.
- Blocks with double interlock must be used for trafficked areas.
- Cast in-situ concrete pavements should be considered for areas extensively used by heavy vehicles and evaluated in terms of future maintenance.

## **ASPHALT BITUMINOUS SURFACING**

- Bituminous surfacing should be considered for large areas to be surfaced, such as roads and streets in departmental complexes, due to a possible cost advantage.
- A total lifecycle cost comparison is to be made to decide whether bituminous surfacing or interlocking blocks should be used.
- Due consideration should be given to the lighter forms of surfacing such as single/double seals etc., where possible, for economic reasons.

## **CROSSING OF EXISTING PIPELINES AND OTHER SERVICES**

The design is to comply with Rand Water pipeline protection standards and specifications.

## **STORM WATER**

The contractor shall develop a Storm-water Drainage Plan for the area and will ensure that the run-off from the site will discharge into the existing or new designed drainage system. The storm-

water infrastructure must be designed in accordance with the guidelines provided in the South African National Roads Agency Limited (SANRAL) Drainage Manual.

#### Subsoil drainage

The contractor shall take into account the surface and subsoil conditions when planning storm-water infrastructure, and shall in particular note of the ground water table if noted in the Geotechnical investigation report done.

Subsurface drainage is an important element in the management of water. The handling of subsurface drainage is extensively covered in the TRH 15 document "Subsurface Drainage for Roads" published by the CSIR. This water shall be safely and suitably conveyed to the storm-water system as part of the storm-water drainage plan.

In dolomite areas subsurface drainage may not be allowed except if designed by a specialist in construction on dolomite areas (to be approved by Engineer).

#### Flow velocities

Storm-water channels (including road edge channels) shall be designed so that flow velocities in the channels do not exceed 2,5 m/s.

#### Erosion Control

- Open exposed areas should be planted with grass or landscaped into gardens.
- Using natural rock and boulders to act as energy dissipaters.
- All exposed embankments should be covered in 100mm topsoil and planted with grass sods and staked to prevent washing away.
- All cut/fill embankments steeper than 1:2 should be covered in soil saver with sufficient overlaps, covered in 100mm topsoil and planted with grass.
- Reducing the velocity of all stormwater run-off through energy dissipaters
- Promotion of infiltration of surface run-off through the introduction of sustainable drainage systems, especially at the outlets from the stormwater attenuation pond.

## CHECKLIST

| 1. General Project Requirements |   | YES | NO | N/A |
|---------------------------------|---|-----|----|-----|
| 1.1                             | Has the project brief been reviewed and discussed?  |     |    |     |
| 1.2                             | Are the contract technical specifications, including design specifications, well understood and being followed (including seismic, geological, anticipated loading, service life and service/maintenance requirements)? |     |    |     |
| 1.3                             | Have the traffic capacity requirements of the road been discussed?  |     |    |     |
| 1.4                             | Are the correct drawing and design file specifications being used?  |     |    |     |
| 1.5                             | Have all the required authorisations been obtained?   |     |    |     |
| 1.6                             | Has all required information to commence with the project been obtained, including project qualifications?  |     |    |     |
| 1.7                             | Have the project specifications pertaining to the space limitations and servitudes been considered/discussed?   |     |    |     |
| 1.8                             | Have the project battery limits and servitude limitations been considered and discussed?  |     |    |     |
| 1.9                             | Was a design programme approved, submitted and on file?   |     |    |     |
| 1.10                            | Is the Consultant working to the latest design programme?   |     |    |     |
| 1.11                            | Are there any variations to the original contract requirements or specifications? have these variations been noted and discussed?   |     |    |     |
| 1.12                            | Have the necessary surveys been commissioned and undertaken?  |     |    |     |
| 1.13                            | Have the high-level/desktop geotechnical and topographical studies been undertaken?   |     |    |     |
| 1.14                            | Has all required information for existing infrastructure (road furniture, interconnecting roads, etc.) been obtained?   |     |    |     |
| 1.15                            | Has a comprehensive Services detection been conducted and submitted to Rand Water? Have service providers been informed on the anticipated impact on their services of the proposed construction?                       |     |    |     |
| 1.16                            | Have the sources for potable water, construction water and electricity been identified and authorisation for their use been obtained?   |     |    |     |
| 1.17                            | Has a list of the detailed services that will be required been compiled (e.g. Geotech, seismic, hydrological etc.)?   |     |    |     |
| 1.18                            | Has the RW Operations team been engaged on the requirements to be adhered to (including access to site during concrete)?  |     |    |     |
| 1.19                            | Have other discipline specific designs been sufficiently concluded to allow for a detailed design of the road geometrics and stormwater?  |     |    |     |
| 1.20                            | Have water sources been identified and testing thereof discussed?   |     |    |     |
| 1.21                            | Are land use and anticipated infrastructure discussed and any conclusions drawn?  |     |    |     |
| 1.22                            | Are the details of the Consultant's appointment, brief and site handover inspection understood?   |     |    |     |
| 1.23                            | Were aspects pertaining to the temporary construction road concluded?   |     |    |     |

|                          |   |            |           |            |
|--------------------------|---|------------|-----------|------------|
| 1.24                     | Were the relevant traffic studies undertaken and concluded?   |            |           |            |
| 1.25                     | Were the relevant community and stakeholder engagements held and outcomes recorded?   |            |           |            |
| 1.26                     | Have the overflow discharge points been considered?   |            |           |            |
| 1.27                     | Has the drainage point for stormwater, overflow and reservoir drainage been identified, and authorisation for use obtained? |            |           |            |
| 1.28                     | Was the visual assessment of the condition of the existing pavement/area carried out in accordance with TRH6 and TMH9?      |            |           |            |
| 1.29                     | Is there a report summarizing the visual assessment?  |            |           |            |
| 1.30                     | Are there photographic records in the report?   |            |           |            |
| 1.31                     | Is there a discussion regarding the collection of visual assessment data?   |            |           |            |
| 1.32                     | <b>OHS Obligations:</b>   |            |           |            |
| 1.32.1                   | Are the project requirements in terms of OHS Specification Understood?  |            |           |            |
| 1.32.2                   | Have the OHS Specification requirements been discussed?   |            |           |            |
| 1.32.3                   | Is there a project specific baseline risk assessment?   |            |           |            |
| 1.33                     | <b>Project Risk Obligations:</b>  |            |           |            |
| 1.33.1                   | Has project risks been identified in terms of likelihood and severity?  |            |           |            |
| 1.33.2                   | Are mitigation measures proposed to minimise risks?   |            |           |            |
| 1.34                     | <b>Environmental Obligations:</b>   |            |           |            |
| 1.34.1                   | Has the appropriate environmental specifications and processes been identified?   |            |           |            |
| 1.34.2                   | Have special environmental mitigating measures been identified discussed (noise, dust etc.)                                 |            |           |            |
| 1.34.3                   | Is there an environmental management plan in the report?  |            |           |            |
| 1.34.4                   | Has an environmental practitioner been identified?  |            |           |            |
| 1.34.5                   | Has application been submitted to DEA/DMR?  |            |           |            |
|                          |   |            |           |            |
| <b>2. Concept Design</b> |   | <b>YES</b> | <b>NO</b> | <b>N/A</b> |
|                          | <b>Existing Information:</b>  |            |           |            |
| 2.1                      | Is the existing cross section of the main road, crossroads and intersections described?                                     |            |           |            |
| 2.2                      | Are drawings/illustrations showing cross section, lane and shoulder widths etc. provided?                                   |            |           |            |
| 2.3                      | Is the existing pavement structure discussed?   |            |           |            |
| 2.4                      | Is the existing servitude identified?   |            |           |            |
| 2.5                      | Has a road survey been conducted and submitted to Rand Water?   |            |           |            |
|                          |   |            |           |            |



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|        | <b>Traffic Analysis:</b>   |  |  |  |
| 2.6    | Are the current traffic figures discussed?   |  |  |  |
| 2.7    | Is the traffic growth for ADT, ADTT and E80's calculated?  |  |  |  |
| 2.8    | Is the pavement/traffic class to be designed discussed?  |  |  |  |
| 2.9    | Is the 30th highest volume percentile discussed?   |  |  |  |
| 2.10   | Has the capacity on all intersecting roads/interchanges identified and categorised?  |  |  |  |
| 2.11   | Conclusions discussed?   |  |  |  |
|        | <b>Concept Design:</b>   |  |  |  |
| 2.12   | Have several concept designs (e.g. Concrete, block paving, bitumen, stabilised, natural) been presented to and discussed with the project team?  |  |  |  |
| 2.13   | Have the concept designs been reviewed and shortlisted by RW?  |  |  |  |
| 2.14   | Are the contract technical specifications, including design specifications, well understood and being followed (including seismic, geological, anticipated loading, service life and service/maintenance requirements)?                                  |  |  |  |
| 2.15.1 | Has a list of required services, surveys and investigations been compiled and discussed? (including, geotechnical, topographical survey, services detection, blasting investigation, conditional and structural assessments of existing structures etc.) |  |  |  |
| 2.15.2 | Have the specifications for the required services been compiled?   |  |  |  |
| 2.16   | Have required services, surveys and investigations been commissioned? (including visual assessments)   |  |  |  |
| 2.17   | Have the lead times for services, survey and investigations been incorporated into the design programme?   |  |  |  |
| 2.18   | Have the durability specification requirements been established and discussed, including plant service life? Is this specification included into the road maintenance plan?  |  |  |  |
| 2.19   | Has all design information been recorded, documented and presented to Rand Water for records keeping? Including native format for proprietary software including a viewer.   |  |  |  |
| 2.20   | Has a high level cost benefit analysis of the various options been undertaken?   |  |  |  |
| 2.21   | Have all the various aspects of the project been considered:   |  |  |  |
| 2.21.1 | Have all material options been considered?   |  |  |  |
| 2.21.2 | Have all construction techniques and maintenance implications been considered?   |  |  |  |
| 2.21.3 | Have all earthworks considerations been discussed - including cut, fill, slope stability?  |  |  |  |
| 2.21.4 | Has the re-use of material been considered discussed (e.g. reuse of excavation material as fill)?  |  |  |  |
| 2.21.5 | Have the seismic and geological aspects been considered?   |  |  |  |
| 2.22   | Is the topography, vegetation, population and climate discussed (temperature and rainfall) and basic geology discussed, and any conclusions drawn?   |  |  |  |
| 2.23   | Have meeting minutes been recorded and filed?  |  |  |  |
| 2.24   | Have innovative technologies, techniques and methods been considered for the concepts considered?  |  |  |  |
| 2.25   | Has the innovation component of the concepts considered been included in the costs benefit analysis?   |  |  |  |

| 3. Preliminary Design |  | YES | NO | N/A |
|-----------------------|--|-----|----|-----|
| <b>A.</b>             | <b>General Preliminary Design Considerations:</b>  |     |    |     |
| 3.1                   | Has a preliminary design of the concept design shortlist been undertaken?  |     |    |     |
| 3.2                   | Have the preliminary designs been reviewed?  |     |    |     |
| 3.3                   | Have all design specifications been considered and implemented?  |     |    |     |
| 3.4                   | Has all the information received from the required services, surveys and investigations been considered and incorporated into the preliminary design?                            |     |    |     |
| 3.5                   | Has a preliminary durability design been undertaken, where required for structures?  |     |    |     |
| 3.6                   | Has a detailed costs benefit analysis of the preliminary design options been undertaken, presented and discussed? Including maintenance plan?                                    |     |    |     |
| 3.7                   | Has all construction information been recorded, documented and presented to Rand Water for records keeping? Including native format for proprietary software including a viewer. |     |    |     |
| 3.8                   | Have all the various aspects of the project been considered and covered under the preliminary design:  |     |    |     |
| 3.8.1                 | Have all material options been considered?   |     |    |     |
| 3.8.2                 | Have all reinforcement methods been considered?  |     |    |     |
| 3.8.3                 | Have all earthworks considerations been discussed - including cut, fill, slope stability and anchoring?  |     |    |     |
| 3.8.4                 | Ground water, storm-water and sub-soil drainage?   |     |    |     |
| 3.8.5                 | Has the re-use of material been considered discussed (e.g. re-use of excavation material as fill)?   |     |    |     |
| 3.8.6                 | Have the seismic aspects been considered?  |     |    |     |
| 3.9                   | Have all the requisite documents been signed by relevant professional?   |     |    |     |
| 3.10                  | Was a multi-discipline integration and review undertaken?  |     |    |     |
| 3.11                  | Was the structural health monitoring aspect considered in the various preliminary design options?  |     |    |     |
| 3.12                  | Have the asset managers and other relevant stakeholders been engaged on the works to be undertaken and its likely impact to existing infrastructure?                             |     |    |     |
| 3.13                  | Have meeting minutes been recorded and filed?  |     |    |     |
| 3.14                  | Have mix design considerations been made?  |     |    |     |
| 3.15                  | Have stormwater considerations been made?  |     |    |     |
| 3.16                  | Have the temporary works considerations for the various design options been considered?  |     |    |     |
| <b>B.</b>             | <b>Specific Preliminary Design Considerations:</b>   |     |    |     |
| 3.17                  | <b>Introduction, Locality, Key Plan</b>  |     |    |     |
| 3.17.1                | Is there a locality and key plan bound in the report?  |     |    |     |
| 3.17.2                | Are the project limits indicated on the locality plan?   |     |    |     |
| 3.18                  | <b>Pavement Design:</b>  |     |    |     |
| 3.18.1                | Is there a locality and key plan bound in the report?  |     |    |     |

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| 3.18.2  | Have these upgrade and rehabilitation actions been mechanistically analysed and double checked?  |  |  |  |
| 3.18.3  | Are there any conclusions drawn?   |  |  |  |
| 3.18.4  | Was the do-nothing option considered?  |  |  |  |
| 3.18.5  | Is there consideration for labour intensive pavement construction?   |  |  |  |
| 3.18.6  | Are there different upgrade options discussed in detail including quantities and a cost estimate?  |  |  |  |
| 3.18.7  | Is there a discussion and conclusion regarding the type of surfacing proposed?   |  |  |  |
| 3.18.8  | If a seal is proposed, have the preliminary design parameters been checked?  |  |  |  |
| 3.18.9  | Are the road cross-sections discussed and any recommendations made?  |  |  |  |
| 3.18.10 | Are all the services below road level identified and shown accurately on the drawings?   |  |  |  |
| 3.18.11 | Does the design accommodate a minimum 1m cover from finished road level to top of Rand Water pipes?  |  |  |  |
| 3.18.12 | Has pipe protection measures been identified, designed, discussed and accepted by Rand Water?  |  |  |  |
| 3.18.13 | Are the horizontal alignment discussed and any recommendations made?   |  |  |  |
| 3.18.14 | Are the vertical alignment discussed and any recommendations made?   |  |  |  |
| 3.19    | <b>Materials:</b>  |  |  |  |
| 3.19.1  | Have slope and pavement stability been discussed?  |  |  |  |
| 3.19.2  | Was a soil survey of existing pavement and possible widening carried out?  |  |  |  |
| 3.19.3  | Are the properties of the different pavement layer materials discussed and shown in the report?  |  |  |  |
| 3.19.4  | Has the re-use of material been discussed?   |  |  |  |
| 3.19.5  | Are the approximate material volume requirements calculated?   |  |  |  |
| 3.19.6  | Are the potential material sources (including commercial sources) availability and properties discussed?   |  |  |  |
| 3.19.7  | Is there a cost comparison carried out between potential sources?  |  |  |  |
| 3.19.8  | Have water sources been identified and testing thereof discussed?  |  |  |  |
| 3.19.9  | Is the as-built information confirmed by the investigation?  |  |  |  |
| 3.19.10 | Are there any conclusions drawn?   |  |  |  |
| 3.20    | <b>Geometry:</b>   |  |  |  |
| 3.20.1  | Are applicable geometric standards followed e.g. TRH17 and SANRAL Geometric Design Guideline, Guidelines for Human Settlement Planning and Design? |  |  |  |
| 3.20.2  | Is a detailed assessment of existing geometric features discussed for main road, intersections and accesses?                                       |  |  |  |
| 3.20.3  | Are different design options discussed for the road, intersection and accesses?  |  |  |  |
| 3.20.4  | Are layouts, cross section and vertical alignment drawings provided?   |  |  |  |
|         |  |  |  |  |

|                           |   |            |           |            |
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| 3.21                      | <b>Road Prism Drainage:</b>   |            |           |            |
| 3.21.1                    | Is there a general description and summary of all drainage structures in the report?  |            |           |            |
| 3.21.2                    | Has the condition of all structures been analysed?  |            |           |            |
| 3.21.3                    | Has the hydrology of all drainage structures been analysed?   |            |           |            |
| 3.21.4                    | Has depth of flow over the road surface been determined and discussed?  |            |           |            |
| 3.21.5                    | Are subsoil drainage matters discussed?   |            |           |            |
| 3.21.6                    | Have alternative repair options been discussed, including quantities and cost estimates?  |            |           |            |
| 3.22                      | <b>Structure Hydraulics:</b>  |            |           |            |
| 3.22.1                    | Has a separate hydraulics report been submitted and attached to appendices?   |            |           |            |
| 3.22.2                    | Is a summary of each structure's hydraulic capacity provided?   |            |           |            |
| 3.22.3                    | Are recommendations made for improvements required?   |            |           |            |
| 3.23                      | <b>Structures:</b>  |            |           |            |
| 3.23.1                    | Has a report for all the structures been submitted and attached to appendices?  |            |           |            |
| 3.23.2                    | Is a summary of each structure provided (type, size etc.)   |            |           |            |
| 3.23.3                    | Are the proposed improvements and new structures required discussed?  |            |           |            |
| 3.24                      | <b>Evaluation:</b>  |            |           |            |
| 3.23.1                    | Was the COLTO/SANS database used in the cost estimate?  |            |           |            |
| 3.23.2                    | Is there an item in the BoQ for the designers site supervision and monitoring for the duration of the construction stage?   |            |           |            |
|                           |   |            |           |            |
| <b>4. Detailed Design</b> |   | <b>YES</b> | <b>NO</b> | <b>N/A</b> |
| <b>A.</b>                 | <b>General Preliminary Design Considerations:</b>   |            |           |            |
| 4.1                       | Has a detailed design based on the preliminary design been undertaken?  |            |           |            |
| 4.2                       | Have the detailed designs been reviewed?  |            |           |            |
| 4.3                       | Have all design specifications been considered and implemented?   |            |           |            |
| 4.4                       | Has all the information received from the required services, surveys and investigations been considered and incorporated into the detailed design?  |            |           |            |
| 4.5                       | Has a detailed durability design been undertaken?   |            |           |            |
| 4.6                       | Has a detailed costs benefit analysis of the detailed design been undertaken, presented and discussed? Including maintenance requirements and testing specifications for durability criteria? |            |           |            |
| 4.7                       | Has all construction information been recorded, documented and presented to Rand Water for records keeping? Including native format for proprietary software including a viewer.              |            |           |            |
| 4.8                       | Have all the various aspects of the project been covered under the detailed design:   |            |           |            |
| 4.8.1                     | Have all material options been considered?  |            |           |            |
| 4.8.2                     | Have all reinforcement methods been considered?   |            |           |            |

|           |  |  |  |  |
|-----------|--|--|--|--|
| 4.8.3     | Have all earthworks considerations been discussed - including cut, fill, slope stability?  |  |  |  |
| 4.8.4     | Has the re-use of material been considered discussed (e.g. reuse of excavation material as fill)?  |  |  |  |
| 4.8.5     | Durability Measurement Specifications?   |  |  |  |
| 4.8.6     | Have the seismic aspects been considered?  |  |  |  |
| 4.9       | Have all connecting services been considered for re-routing, re-use or retrofit?   |  |  |  |
| 4.10      | Was the detailed structural health monitoring specification completed and discussed? Does the specification make consideration of the critical design components to be attended to during construction and implementation? (e.g. Differential settlement, heat of hydration for deep concrete sections? seismic movement?) |  |  |  |
| 4.11      | Was a multi-discipline integration and review undertaken (including small power and lighting where required)?  |  |  |  |
| 4.12      | Have meeting minutes been recorded and filed?  |  |  |  |
| 4.13      | Have the asset managers been engaged on the works to be undertaken and its likely impact to existing structures?   |  |  |  |
| 4.14      | Has a detailed bill of quantities been compiled?   |  |  |  |
| 4.15      | Have all the specifications been compiled and reviewed for construction?   |  |  |  |
| 4.16      | Have special construction methods and procedures been trialed?   |  |  |  |
| 4.17      | Have all stormwater designs been concluded? And discussed?   |  |  |  |
| <b>B.</b> | <b><i>Specific Preliminary Design Considerations:</i></b>  |  |  |  |
| 4.18      | <b><i>Introduction, Locality, Key Plan</i></b>   |  |  |  |
| 4.18.1    | Is there a locality and key plan bound in the report?  |  |  |  |
| 4.18.2    | Are the project limits indicated on the locality plan?   |  |  |  |
| 4.19      | <b><i>Pavement Design:</i></b>   |  |  |  |
| 4.19.1    | Is there a locality and key plan bound in the report?  |  |  |  |
| 4.19.2    | Have these upgrade and rehabilitation actions been mechanistically analysed and double checked?  |  |  |  |
| 4.19.3    | Are there any conclusions drawn?   |  |  |  |
| 4.19.4    | Was the do-nothing option considered?  |  |  |  |
| 4.19.5    | Is there consideration for labour intensive pavement construction?   |  |  |  |
| 4.19.6    | Are there different upgrade options discussed in detail including quantities and a cost estimate?  |  |  |  |
| 4.19.7    | Is there a discussion and conclusion regarding the type of surfacing proposed?   |  |  |  |
| 4.19.8    | If a seal is proposed, have the preliminary design parameters been checked?  |  |  |  |
| 4.19.9    | Are the road cross-sections discussed and any recommendations made?  |  |  |  |
| 4.19.10   | Are all the services below road level identified and shown accurately on the drawings?   |  |  |  |
| 4.19.11   | Does the design accommodate a minimum 1m cover from finished road level to top of Rand Water pipes?  |  |  |  |
| 4.19.12   | Has pipe protection measures been identified, designed, discussed and accepted by Rand Water?  |  |  |  |
| 4.19.13   | Are the horizontal alignment discussed and any recommendations made?   |  |  |  |
| 4.19.14   | Are the vertical alignment discussed and any recommendations made?   |  |  |  |
| 4.20      | <b><i>Materials:</i></b>   |  |  |  |
| 4.20.1    | Have slope and pavement stability been discussed?  |  |  |  |
| 4.20.2    | Was a soil survey of existing pavement and possible widening carried out?  |  |  |  |

|                      |  |            |           |            |
|----------------------|--|------------|-----------|------------|
| 4.20.3               | Are the properties of the different pavement layer materials discussed and shown in the report?  |            |           |            |
| 4.20.4               | Has the re-use of material been discussed?   |            |           |            |
| 4.20.5               | Are the approximate material volume requirements calculated?   |            |           |            |
| 4.20.6               | Are the potential material sources (including commercial sources) availability and properties discussed?   |            |           |            |
| 4.20.7               | Is there a cost comparison carried out between potential sources?  |            |           |            |
| 4.20.8               | Have water sources been identified and testing thereof discussed?  |            |           |            |
| 4.20.9               | Is the as-built information confirmed by the investigation?  |            |           |            |
| 4.20.10              | Are there any conclusions drawn?   |            |           |            |
| 4.21                 | <b>Geometry:</b>   |            |           |            |
| 4.21.1               | Are applicable geometric standards followed e.g. TRH17 and SANRAL Geometric Design Guideline, Guidelines for Human Settlement Planning and Design? |            |           |            |
| 4.21.2               | Is a detailed assessment of existing geometric features discussed for main road, intersections and accesses?                                       |            |           |            |
| 4.21.3               | Are different design options discussed for the road, intersection and accesses?  |            |           |            |
| 4.21.4               | Are layouts, cross section and vertical alignment drawings provided?   |            |           |            |
| 4.22                 | <b>Road Prism Drainage:</b>  |            |           |            |
| 4.22.1               | Is there a general description and summary of all drainage structures in the report?   |            |           |            |
| 4.22.2               | Has the condition of all structures been analysed?   |            |           |            |
| 4.22.3               | Has the hydrology of all drainage structures been analysed?  |            |           |            |
| 4.22.4               | Has depth of flow over the road surface been determined and discussed?   |            |           |            |
| 4.22.5               | Are subsoil drainage matters discussed?  |            |           |            |
| 4.22.6               | Have alternative repair options been discussed, including quantities and cost estimates?   |            |           |            |
| 4.23                 | <b>Structure Hydraulics:</b>   |            |           |            |
| 4.23.1               | Has a separate hydraulics report been submitted and attached to appendices?  |            |           |            |
| 4.23.2               | Is a summary of each structure's hydraulic capacity provided?  |            |           |            |
| 4.23.3               | Are recommendations made for improvements required?  |            |           |            |
| 4.24                 | <b>Structures:</b>   |            |           |            |
| 4.24.1               | Has a report for all the structures been submitted and attached to appendices?   |            |           |            |
| 4.24.2               | Is a summary of each structure provided (type, size etc.)  |            |           |            |
| 4.24.3               | Are the proposed improvements and new structures required discussed?   |            |           |            |
| 4.25                 | <b>Evaluation:</b>   |            |           |            |
| 4.25.1               | Was the COLTO/SANS database used in the cost estimate?   |            |           |            |
| 4.25.2               | Is there an item in the BoQ for the designers site supervision and monitoring for the duration of the construction stage?                          |            |           |            |
| <b>5. Appendices</b> |  | <b>YES</b> | <b>NO</b> | <b>N/A</b> |
| 5,1                  | Is there a reference from the text to appendices?  |            |           |            |
| <b>6. Other</b>      |  | <b>YES</b> | <b>NO</b> | <b>N/A</b> |
| 6,1                  | Has an inventory of all road side furniture been provided?   |            |           |            |

## 8. RECORD AND DATA KEEPING

| Record Document                              | Form/Doc Number  | Location                 | Retention Period |
|--|------------------|--------------------------|------------------|
| Design Report / Design Calculations template | Work in progress | T – Drive/ Design Office | 5 years          |
| Drawing Templates                            | Work in progress | T– Drive/Design Office   | 5 years          |
|  |                  |                          |                  |

## 9. DOCUMENT CHANGE HISTORY

The following table contains the history of this document with a description of each revision.

| Date     | Previous Revision Number | New Revision Number | Description of Each Revision                |
|----------|--------------------------|---------------------|---|
| May 2015 | Original                 | 00                  |   |
| May 2024 | 00                       | 01                  | Template changed, references and formatting |
|          |                          |                     |   |