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Rehabilitation of Access Roads at
Tutuka Power Station**

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1. Introduction

Tutuka Power Station is located within the Gert Sibande district; in the Lekwa Local municipality, approximately 21 km northeast of the Standerton town in the Mpumalanga Province and adjacent to the Seriti owned New Denmark Colliery. The greater power station consists of three separate areas, namely the Coal Stock Yard (CSY), the Ash Disposal and the Main Power Station whereby the flexible pavements have been identified as needing urgent rehabilitation.

The purpose of this document is to develop the technical requirements for the rehabilitation of the Stations Access Roads where the works will include but is not limited to drainage, general pavement reconstruction, pothole and edge break repairs, filling cracks and rutting as well as general aggregate losses.

2. Supporting Clauses

2.1 Scope

- The *Contractor* to be equipped with a Professional Engineer/ Technologist, registered with ECSA, to conduct all necessary site investigations and conduct pavement and drainage design to support rehabilitation of the roads.
- The *Contractor* to supply and set out the necessary traffic control measures and signs near the repair works, and to provide a safe alternative route for vehicles during repairs.
- The *Contractor* to supply and deliver all necessary materials, machinery, tools and equipment required for the rehabilitation of the access roads.
- The *Contractor* to provide all necessary skills and labour to execute the repair works of the accessroads that are inclusive of but not limited to pavement failures, potholes, cracks, rutting, aggregate loss and drainage defects.

2.1.1 Purpose

The purpose of this document is to provide the technical requirements in the scope of work for the rehabilitation of Tutuka Power Station Access Roads

2.1.2 Applicability

This document shall apply to Tutuka Power Station only.

2.1.3 Effective date

The effective date will be from the authorisation date.

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2.1.4 Disclosure Classification

Controlled Disclosure: Controlled Disclosure to external parties (either enforced by law, or discretionary)

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] ISO 9001 Quality Management Systems
- [2] 240-57127951: Standard for the Execution of Site Investigations
- [3] ECSA Code of Conduct for Registered Persons: Engineering Profession Act, 2000, (Act No.46 of 2000)
- [4] 240-54179170 Technical Documentation Classification and Designation Standard
- [5] 240-57127951 Standard for the Execution of Site Investigations
- [6] 240-57127953 Execution of Site Preparation and Earthworks Standard
- [7] 240-91244751 Specification for Geotechnical Investigations Standard
- [8] 240-142483465 Guidelines on Maintenance and Rehabilitation of Roads
- [9] 240-57127955 Geotechnical and Foundation Engineering Standard
- [10] 240-85549846 Standard for Design of Drainage and Sewerage Infrastructure
- [11] 240-100176167 Excavations
- [12] 240-65459834 Gx Project Documentation Deliverable Requirement Specification
- [13] 240-66920003 Project Handover Document Management Procedure
- [14] 240-76992014 Project / Plant Specific Technical Documents and Records Management Work Instruction
- [15] 240-84418186 Road Specification Manual
- [16] COLTO Standard Specifications for Road and Bridge Works for State Owned Assets
- [17] ISO 9001: 2008 Quality Management Systems
- [18] OHS Act Occupational Health and Safety Act 85 of 1983
- [19] 0.61_00680 Tutuka Power Station Roads: Layout Plan Within Main Station Area
- [20] 0.61_00683 Tutuka Power Station Roads: Longitudinal Section Main Access Road Area
- [21] 0.61_00731 Layout Plan for Road Signs and Markings within Main Station Area
- [22] SABS 1200M: 1996 SABS of Standard Standardized Specification for Civil Engineering Construction: M Roads (General)

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[23] SANS South African National Standards

[24] SARTSM South African Road Traffic Signs Manual 3rd edition, Volume 3

[25] TMH Technical Manual for Highways Series

[26] TRH Technical Recommendation for Highways Series

2.2.2 Informative

[1] 240-99527377 Inspection Manual For Civil Works at Eskom's Power Stations

[2] 360-TUT-ADDB-D00180-7 Tutuka Power Station Roads and Railway Inspection Report

[3] SABITA South African Bitumen Association Series

[4] SAPEM South African Pavement Engineering Manual Series

[5] 0.61/00077-Rev 8. Storm Water Drainage Layout

2.2.3 Drawings

| Drawing Number | Revision | Title |
|----------------|----------|--|
| 0.61/310 | 2 | Tutuka Power Station Key Plan |
| 0.61/323 | 1 | Typical Cross Section |
| 0.61/680 | 8 | Tutuka Power Station Roads: Layout Plan Within Main Station Area |
| 0.61/683 | 2 | Tutuka Power Station Roads: Longitudinal Section Main Access Road Area |
| 0.61/717 | 3 | Typical Cross Section-Sheet 1 |
| 0.61/718 | 1 | Typical Cross Section-Sheet 3 |
| 0.61/721 | 0 | Typical Inlet Details-Type 2A & 2B |
| 0.61/722 | 0 | Typical Inlet Details-Type 3A & 3B |
| 0.61/729 | 0 | Typical Kerb Details |
| 0.61/731 | 1 | Layout Plan for Road Signs and Markings within Main Station Area |

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| 0.61/734 | 8 | Layout Plan for Service Ducts |
| 0.61/738 | 6 | Layout Plan for Telecommunications |
| 0.61/744 | 16 | Layout Plan for Main Terrace Drainage |
| 0.61/133 | 3 | Drainage GA. Road. Dirty. Storm Water. Sewer |
| 0 61/55330 | 0 | Common Plant Station Drain System PID |
| 0 61/36 | 19 | Water and Electrical layout |
| 0.61/8838 | 0 | Coal Stockyard Road Layout |

2.3 Definitions

| Term | Definition |
|------------------|---|
| Access Roads | Pavement structure which is a combination of stone or gravel layers, with the riding surface comprising of asphalt or seals. The roads grant light and heavy vehicles free access and safe mobility to other roads. |
| Broom-off | To remove excess materials on the surface of the paving blocks by sweeping. |
| Cracking | Flexible pavement distress most often instigated by failure of the surfacedue to traffic loading. |
| Concrete repairs | Process of fixing a hardened concrete surface that over time has lost the ability to hold the binding concrete materials together due to damage or environmental exposure. |
| Contractor | Will supply materials and equipment to perform the necessary works and will also be responsible for the execution of the works |
| De-bonded areas | Surface that has become loose and no longer adheres to the underlyinglayer. |
| Design Engineer | Pr.Eng/Pr.Tech appointed by Contractor to conduct detail design and supervise quality of works related to the road rehabilitation works |

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| Edge break | Failure which occurs on the shoulder lane or outer end of the lane |
| Flexible Pavement | Able to bend on the support. Typically asphalt or seal surfacing. |
| Heavy Vehicles | A motor vehicle with at least one heavy axle and/or any vehicle which is principally designed or adapted for the conveyance of persons exceeding sixteen (16) in number |
| Pavement Failure | Damage to the underlying layers of the pavement structure beneath the surface, which may extend into the base or sub base |
| Professional Engineer/Technologist | A technical engineering professional that is registered with ECSA in accordance with the Engineering Profession Act No.46 of 2000 |
| Potholes | A depression or hollow in a road surface caused by wear or subsidence, generally due to water ingress |
| Rutting | Permanent deformation or consolidation accumulates in a pavement surface over time, typically shown by the wheel path engraved in the road |
| Surface failure | Damage to the top layer of the pavement structure whereby vehicles traverse on |

2.4 Abbreviations

| Abbreviation | Description |
|--------------|--|
| COLTO | Committee of Land Transport Organization |
| CSY | Coal Stock Yard |
| ECSA | Engineering Council of South Africa |
| EDWL | Engineering Design Work Lead |
| EMP | Environmental Management Plan |
| OHSA | Occupational Health and Safety Act |
| Pr.Eng | Professional Engineer |
| Pr.Tech | Professional Technologist |
| QCP | Quality Control Plan |
| SABITA | South African Bitumen Association |
| SABS | South African Bureau of Standards |
| SANS | South African National Standards |

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| SAPEM | South African Pavement Engineering Manual |
| CBR | California Bearing Ratio |
| SARTMS | South African Road Traffic Manual Signs |
| TRH | Technical Recommendations for Highways |
| TMH | Technical Methods for Highways |
| VDSS | Vendor Document Submission Schedule |

2.5 Roles and Responsibilities

2.5.1 Civil Engineering Manager

- Reviews the Works Information Document and signs as the functional responsibility.

2.5.2 Engineering Manager

- Authorises the Works Information Document.

2.5.3 Civil Engineer

- Compiles the Works Information Document.
- Develops all the required documents for this modification and arranges for a review session for technical specifications and detail design review if applicable;
- Performs the functions of Engineering Design Work Lead (EDWL);
- Facilitates with other team members to assure asset technical integrity by checking that the user, Eskom engineering and regulatory requirements are met;
- Co-ordinates all the engineering works between different engineering disciplines if required;
- Support the Project Manager with regards to civil related technical aspects during the execution of the project.

2.5.4 Contractor

- As per the OHS Act
- Supply and deliver all necessary materials, tools and equipment required for the rehabilitation of the access roads and traffic accommodation.
- Provide the labour to perform the necessary design, drainage and repair works

2.5.5 Designer

- As per the OHS Act

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- As per Industry Standards

2.5.6 Environmental

- Ensures that environmental legislation and standards are adhered to and environmental practices are implemented at all times during execution of the works.

2.5.7 Quality

- Ensures that quality legislation and standards are adhered to, and quality practices are implemented at all times during execution of the works.

2.5.8 Safety

- Ensures safety legislation and standards are adhered to and that safety practices are implemented at all times during execution of the works.

2.6 Process for Monitoring

The tender committee will adjudicate the tender evaluation and contract appointment.

The Contractor will compile a QCP, which will ensure the works are executed within the relevant technical, and SHEQ requirements, as well as specified duration including a program/gantt chart.

2.7 Related/Supporting Documents

As per section 2.2

3. Constraints

3.1 General Constraints

- a) A site tender briefing session/scope clarification meeting to be conducted for all prospective tenderers to attend on site at Tutuka Power Station
- b) All technical queries to be directed to Civil Engineering not contravening the procurement process therefore the point of contact is the procurement officer during the procurement process.
- c) Contractor to provide returnable schedules in accordance with the technical evaluation strategy issued by the Employer.
- d) All works to be executed in accordance with standards referenced under section 2.2.
- e) Deliverables/objectives of this works includes but not limited to:

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- i. Submit detailed method statement and material and/or equipment and machinery data sheet for Employer's Civil Engineers to accept before commencement of the works.
- ii. Submit detailed programme/plan including breakdown of tasks to be executed, date of completion for each task and amount of time needed to complete task for Employer to accept before commencement of the works.
- iii. Submit detailed QCP, which ties in with the submitted method statement, signatories to be Contractor, Designer, Eskom Civil Engineer and Eskom quality. QCP must be submitted to Civil Engineering and Civil Quality to approve before commencement of works.
- iv. Conduct all necessary site investigation and assessments to enable effective execution of the scope of work.
- v. Execute scope of work of the rehabilitation of the roads at Tutuka Power Station
- vi. Submit thorough report detailing investigation and assessment findings and provide it in the form of a report.
- vii. Manage and mitigate the operational risks.
- viii. Comply to all SHEQ requirements by ensuring safety of personnel and plant

3.2 Site Constraints

- i. Contractor to provide all machinery, equipment, plant, materials and skilled labour to execute the required works.
- ii. All environmental laws and regulations are to be adhered to during the execution of works.
- iii. The Contractor's tools, machinery, equipment and execution of work must not impair the operation or access to the station.
- iv. During execution of the scope of work, Contractor to share the site with other contractor/s conducting operation and maintenance tasks.
- v. Contractor to ensure there is a smooth flow of traffic whilst repair works are being executed. The required signage must be shown at all times.

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4. Site Description

Over the past years the deterioration of the surfaced roads at Tutuka Power Station has accelerated considerably. A visual inspection was undertaken of the access roads in order to identify potential problem areas and the extent of these failures. The overall deterioration of the road in the form of pavement failures, together with the development of potholes, cracks and rutting were identified as the main mode of failure on the station roads. The failures can be attributed primarily to the stations road maintenance backlog, poor maintenance being applied during previous road repairs, wet periods during rainy season and ponding of water on the road surfaces, as well as a rapid increase in the number of heavy vehicles in and around the station combined with these vehicles stopping and moving at stop streets and during deliveries and their turning movements. It is important to note that although the majority of potholes are expected to develop during the rainy season, it is not uncommon for potholes to develop and deteriorate during the dry season. Figure 2 displays the numbered pavements in the station.

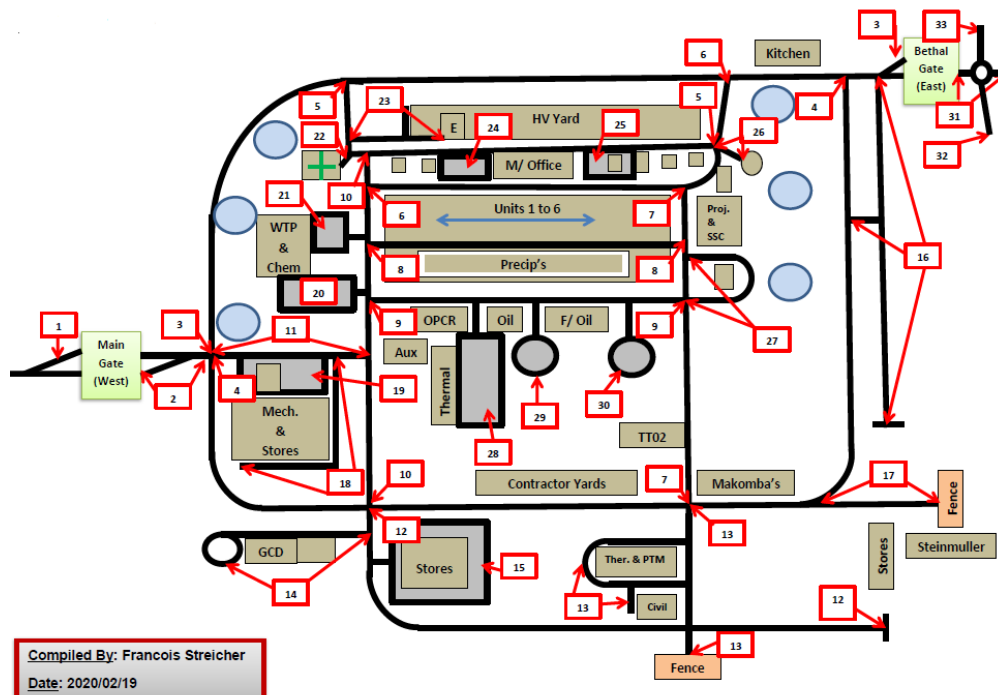


Figure 1: Tutuka Power Station Pavements with Numbers

5. Scope of Work

This section will discuss into detail the technical specifications and requirements necessary for the rehabilitation of Tutuka Power Station and associated areas access roads and associated drainage systems. Appropriate repair measures should be undertaken for the specific type of failure, depending on the root cause.

The scope of work shall include but is not limited to:

- Site investigations and design,

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- b) Rehabilitation/repairs of the road and drainage systems,
- c) Rehabilitation/repairs of the gravel roads.
- d) Survey and CBR's requirements for the new/repaired road pavements.
- e) Testing of materials and workmanship
- f) Provision of traffic control measures during execution of the works
- g) Provision and installation of traffic signs and road marking,
- h) Block Pavement Repair and Replacement

5.1 Site Investigation

The Contractor to conduct underground service detection and all necessary site investigations before commencement of any excavation works. Care to be taken not to damage any services. Contractor to provide all required equipment, machinery, tools, skills and labour to execute underground service detection and site investigation. Contractor to submit detailed findings report to Employer for acceptance, before commencing with the road pavement and associated drainage system detail design and repair works.

Due to the operational requirement for Tutuka roads, Contractor to submit method statement specifying how traffic will be controlled in order to minimize disruptions for other Employees and Contractors to, from and within the station which will not hinder execution of the required works. Contractor submits traffic control method statement for Employer to accept, before commencement of executing rehabilitation/repair works.

5.2 Drainage System

The Contractor to assess the existing site drainage and rehabilitation works to be conducted where necessary. The road pavement detail design is to include measures to correct and/or improve site drainage. The contractor to submit method statement detailing how drainage works will be rectified/improved for Employer's acceptance before commencing with the road pavement detail design.

The Contractor to ensure that the cross fall and surface drainage is maintained when executing the repairs. The cross fall and side drains may need modification in areas with poor drainage. All excavations to be checked for subsurface water to ensure that it is not a contributing factor to the failure and should be corrected if necessary.

The Contractor to take all reasonable precaution to prevent material in excavations, stockpiles and the road from getting excessively wet by rain, storm water or ground water. If necessary, temporary drainage to be constructed to prevent damming of water. All broken/damaged storm water drains shall be replaced.

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5.3 Design

The Contractor to be equipped with a Pr.Eng/Pr.Tech resource who will further develop the scope of work issued by the Employer as per the site conditions and thereafter provide a detailed pavement design solution report aligning with the required works to execute road repairs and site drainage corrections and/or improvements. The works will be limited to isolated areas as identified by the contractor and confirmed by the Employer. Contractor to submit a detailed visual inspection report with recommended repair methods. Contractor to submit design detailing defined solution report and method statement for Employer's acceptance before commencing with the execution of works.

5.4 Traffic Signs and Road Markings

The Contractor must supply and install traffic signage (road signs, road studs) and road markings where necessary as per the SARTMS requirements. The Contractor shall also ensure that temporary signage is set out at the repair site and a safe alternative traffic route is provided during repairs. All guardrails, sign posts, based plates (if required) shall be supplied with nuts, bolts, washers, spacers and fitting materials which may be required. All guardrails, sign posts, base plates (if required) and associated parts (nuts, bolts, washers etc.) shall be hot dip (galvanized) zinc coated or treated by other applicable methods to prevent corrosion. All timber posts and spacer blocks to be treated with a creosote or other applicable methods for timber preservation. No cutting, drilling or shaping of the pole to take place after treating. Excessive cracking should not be observed at the ends. It must be ensured that the guardrails and sign posts are fitted to the appropriate height before backfilling and compacting. After compacting to 90% mod AASHTO, guardrails and posts to be rigid and vertical. Contractor to submit traffic signs and road marking method statement to Employer for acceptance before commencing with the execution of works.

5.5 Road Rehabilitation/Repairs

The Contractor to perform the rehabilitation/repair works which are inclusive of but not limited to pavement failures, potholes, cracks and rutting for pavements and rehabilitation/repair works to gravel roads. The appropriate repair should be carried out based on the root cause of failure which is to be determined by the Contractor. The pavement structure must be adequate to handle the loading exerted by daily traffic and heavy vehicles and have a design life of 30 years. The Contractor to submit detailed design and repair method statement, approved by Contractor's Design Engineer, to Employer for acceptance before commencing with the execution of works. The following repair procedure should be adapted as a guideline and confirmed by the Design Engineer :

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5.5.1 Surface Failure



Figure 2: Surface Damage

1. Remove loose aggregate, sand and ash from road surface where necessary to make the repair area clearly visible to assess and mark
2. Areas adjacent to the failure should be checked for de-bonding by performing a hammer test
3. Mark and measure area to be repaired, area should extend into the sound adjacent surface
4. Remove de-bonded area
5. Clear loose material from the hole
6. SS60 anionic tack coat (30%) to be applied to floor and sides of hole at a rate of 0,55l/m²
7. Apply a screed of coarse slurry for thinner layers or hot fine-grade continuously graded asphalt for thicker layers and roll
8. Surplus material to be taken away to Tutuka's designated General Waste Site which could be within the radius of 30km

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5.5.2 Potholes



Figure 3: Potholes

1. Remove loose aggregate, sand and ash from road surface where necessary to make the repair area clearly visible to assess and mark
2. Mark and measure area to be repaired, area should be marked out in a square or rectangular shape and extend into the sound adjacent surface
3. Cut area to be repaired
4. Remove surface layer (between 10 mm and 55mm in depth depending on the existing layer). The total depth of excavation (surface and base) should be at least a minimum of 40mm
5. Remove base layer (granular or cement) until sound compacted material is identified. If the excavation extends into the sub-base, repair is to be treated as a pavement failure.
6. Clear loose material from the excavation. Cavity to be inspected upon to confirm and record the depth of excavation. Type of repair to be determined based on underlining material (depth at which well compacted layer is found, granular or cement base etc.) as agreed upon by the Employer
7. SS60 anionic tack coat (30%) to be applied to floor and sides of excavation at a rate of 0.55l/m²
8. Lay continuously graded hot mix asphalt surface and compact soon after placing the mix. The number of passes to be recorded. The surface layer should overlap over the repair patch onto the sound adjacent area.
9. Compact to a minimum 95% mod AASTHO. Compaction testing to be done
10. Surplus material to be taken away to Tutuka's designated General Waste Site which could be within the radius of 30km

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5.5.3 Pavement Failure



Figure 4: Pavement Failure

1. Remove loose aggregate, sand and ash from road surface where necessary to make the repair area clearly visible to assess and mark
2. Mark and measure area to be repaired, area should be marked out in a square or rectangular shape and extend into the sound adjacent surface
3. Cut area to be repaired
4. Remove surface layer (between 10 mm and 55mm in depth depending on the existing layer)
5. Remove base layer (granular or cement) until sound compacted material is identified. (Generally, between 150 mm and 300mm depending on existing layers)
6. Clear loose material from the excavation. Cavity to be inspected upon to confirm the depth of excavation. Type of repair to be determined based on underlining material (depth at which well compacted layer is found, granular or cement base etc.) as agreed upon by the Employer. Dynamic Cone Penetration (DCP) Tests must be executed and results submitted in the form of a report.
7. Lay G5 crushed stone sub-base, if required, and compact to 150mm thickness
8. Compact sub-base to a minimum 95% mod AASTHO. Compaction testing to be done
9. Mix and lay emulsion treated base, comprising of G2 crushed stone treated with 3% SS60 anionic stable grade bituminous emulsion at a rate of 0.41l/m² and 1% 32.5N CEM II A-L cement and compact to 150mm thickness. Potable water to be used in mix. Base to be left to cure before

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surfacing.

10. Compact base to a minimum 97% mod AASHTO. Compaction test to be done. Holes should be drilled and not hammered for testing. Contractor to submit compaction test results to Employer for approval, before proceeding with the application of surface layers.
11. Clear any loose or deleterious material from the base layer
12. SS60 anionic tack coat (30%) to be applied to floor and sides of excavation at a rate of 0.55l/m²
13. Lay continuously graded hot mix asphalt surface and compact to 35mm thickness. The surface layer should overlap over the repair patch onto the sound adjacent area. Number of passes to be recorded. Contractor's engineer should provide the hot mix asphalt mix design to the employer for acceptance
14. Compact asphalt to minimum 93% mod AASTHO. Compaction testing to be done
15. Surplus material to be taken away to Tutuka's designated General Waste Site which could be within the radius of 30km

5.5.4 Edge Break



Figure 5: Edge Break Damage

1. Mark and measure area to be repaired, area should extend into sound adjacent surface. Area should be parallel to the road. An isolated section along the area can be repaired closer to the centerline where the extent of

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- failure is larger
2. Cut out area to be repaired
 3. Remove surface layer until sound compacted material is identified. Total depth of excavations should be at least 25mm
 4. Remove all loose material.
 5. Mix and lay emulsion treated base, comprising of G2 crushed stone treated with 3% SS60 anionic stable grade bituminous emulsion at a rate of 0.41l/m² and 1% 32.5N CEM II A-L cement and compact to 150mm thickness. Potable water to be used in mix. Base to be left to cure before surfacing.
 6. Compact base to a minimum 97% mod AASHTO. Compaction test to be done. Holes should be drilled and not hammered for testing. Contractor to submit compaction test results to Employer for acceptance, before proceeding with the application of surface layers.
 7. Clear any loose or deleterious material from the base layer
 8. SS60 anionic tack coat (30%) to be applied to floor and sides of excavation at a rate of 0.55l/m²
 9. Repair shoulder with hot medium-grade continuously graded asphalt. Course slurry can be applied on areas where the base is still in tack. Shutter/batten to be used to support the edge. The width of the lane to be maintained and the asphalt to be compacted to match the slope of the road. Number of passes to be recorded. Shutter/batten to be removed after repair is complete
 10. Shoulder gravel to be dug up (if required), replaced and compacted to surface level. The gravel should be excavated to a max depth of 40mm. The slope of the gravel surface should be away from the road. A concrete edge beam should be constructed at heavily trafficked intersections
 11. Surplus material to be taken to Tutuka's designated General Waste Site which could be within the radius of 30km

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5.5.5 Cracking



Figure 6: Crocodile Cracking

1. Identify crack as active or passive
2. Mark and measure area to be repaired.
3. Blow out cracks using hot compressed air or a wire brush to remove loose material
4. An approved water soluble and non-selective herbicide to be used within cracks if required and weeds to be removed. Repairs to be conducted at least 24hours after application
5. Prime cracks with an invert bitumen emulsion from 80/100 penetration-grade bitumen
6. Fill cracks with a C-E1 modified emulsion. Emulsion should be applied slightly on surface and any excess should be smoothed out to prevent ridges

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5.5.6 Rutting

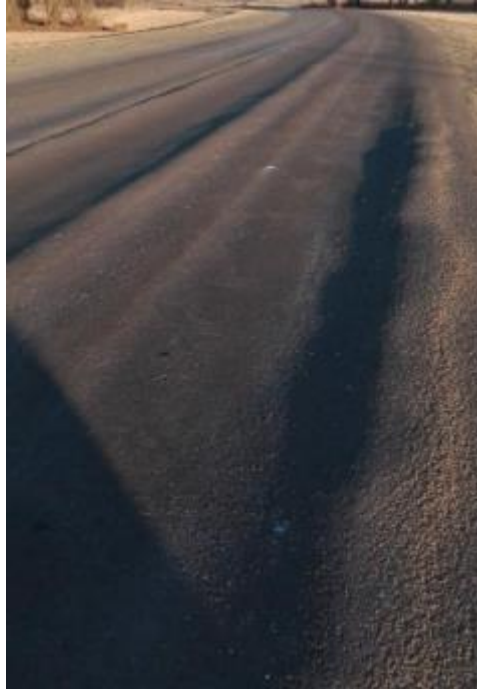


Figure 7: Rutting

1. Mark and measure area to be repaired, areas should extend into sound adjacent surface
2. Anionic spray grade emulsion fog spray (40%) to be applied at a rate of 0.5l/m^2
3. Apply a screed of coarse slurry for thinner layers or hot fine-grade continuously graded asphalt for thicker layers and roll

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5.5.7 Concrete(Rigid Pavement) Repairs



Figure 8: Rigid Pavement Damage

1. Mark and measure area to be repaired, area should include severe adjacent cracks
2. Remove all loose material and old sealants
3. Loose/spalled concrete should be cleaned by using compressed air and wire brushes. Joints/Open cracks should be sandblasted if necessary and clean with compressed air
4. Fill the spalled area with asphalt and compact. A light application of creosote can be applied, allowed to dry/cure and then tacked with a modified emulsion before placing the asphalt to ensure adhesion

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5.5.8 Settled Segmental Block Paving



Figure 9: Settled Segmental Block Paving

1. Mark and measure area to be repaired, area should extend into sound adjacent surface
2. Remove existing paving within area
3. An approved water soluble and non-selective herbicide to be used within cracks if required and weeds to be removed. Repairs to be conducted at least 24hours after application
4. Top 150mm layer to be mechanically compacted to a minimum 90% mod AASHTO. Contractor to submit compaction test results to Employer for acceptance, before proceeding with the paving works.
5. A layer of sand for bedding shall be placed to an uncompacted thickness of 30mm, if required.
6. Paving shall be laid as per the existing/surrounding blocks. Filler pieces to be neatly cut to fit into required space
7. Spaces less than 25% of the full-sized block may be filled with 25MPa concrete
8. Paving blocks shall be compacted by two passes with a compactor, if required
9. Joint sand to be spread and brushed into joints until properly filled
10. Surplus sand must be broomed off
11. Paving may be subjected to an additional two passes, if required. Completed paving to be even and neat, flush with the kerb. Final surface may not deviate more than 15mm from specified level and no irregularities exceeding 10mm may occur during testing with a 3m straight edge

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5.5.9 Gravel Roads



Figure 10: Gravel Road

Gravel roads are generally maintained by routine blading and adding gravel as needed either by re-graveling entire sections or isolated sections. However, almost any gravel road will gradually begin to show distress that requires rehabilitation to correct, which is more than the usual routine maintenance. Rehabilitation will consist of ripping, filling if necessary and compaction of the material. The classification of the wearing course material e.g. G5, G6 or G7 and the number of pavement layers are dependent on the severity of the condition of the gravel road.

An example of a re-gravelling solution irrespective of the classification of the material is shown below;

1. Sub-grade - In-situ material is ripped/scarified to a depth of 150 mm and compacted to 93% Mod AASHTO Density (Material to be imported from suitable commercial source if required).
2. Wearing Course - material is imported from a suitable commercial source.
3. Compacted to 95% Mod AASHTO with a minimum thickness of 150mm.
4. Maximum Size of 37, 7 mm.
5. Oversize Index (Io) \leq 5%.
6. Shrinkage Product (Sp) of 100 – 365 (Preferred 200 – 240).
7. Grading Coefficient (Gc) of 16 – 34 (Preferred 20 – 28).
8. CBR \geq 15 at 95% Mod AASHTO with optimum moisture content.

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5.6 Kerbs

All broken/damaged or removed kerbs shall be replaced and the texture, dimension and colour shall be uniform and in keeping with the existing curbs in the adjacent areas

5.7 Waste Disposal

The Contractor to dispose of all construction rubble at Tutuka's General Waste Site. The quantity of waste (tonnage) to be recorded and waste to be logged as construction rubble at the General Waste Site. Project Manager to arrange with ERI for access to the General Waste Site which could be within the radius of 30km.

6. Testing Material and Workmanship Quality

6.1 Laboratory and Testing

The Contractor to perform all necessary testing related to material and workmanship required for project execution. This shall include but is not limited to laboratory and field-testing. The Contractor to provide their own equipment for testing. The Contractor to provide a detailed breakdown of the testing required for the project executed in the method statement

The Contractor to conduct laboratory verification tests of Emulsion Treated Base and Asphalt Surfacing mix. Findings must be submitted to the Employer's Engineer for review and acceptance. The location, date and site conditions when the sample is taken to be recorded. Compaction tests to be conducted on the sub-base (where applicable) and base layers. All testing and associated costs shall form part of the scope. Any additional recommended tests may be proposed for consideration. The contractor will be responsible for all costs associated with correcting deficiencies in an event of a test failure.

Ordinary test, conducted on a regular basis shall include: -

- Tests to determine properties of natural materials (sand, soil, water, stone etc.) provided by contractor
- Tests on purchased processed natural materials (aggregate for concrete, asphalt, seals etc.)
- Tests to determine properties of products purchased from commercial or subcontracts (concrete, asphalt etc.)
- Tests on completed elements (pavement mixes, concrete mixes) as to establish compliance with specified properties

Special tests will be conducted, if and when required for: -

- Commercial products (cement, paint, bituminous products etc.)
- Structures or elements of structures to determine their efficacy

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6.2 Materials and Equipment

The Contractor shall be responsible for the supply and delivery of all materials, tools, labour and machinery, and equipment necessary to execute the required works. All equipment must be in working order. Contractor to conduct calibration tests on all tools and machinery/equipment where applicable. Contractor to submit valid calibration certificates submitted Employer's acceptance before commencing with works.

Operators must be certified/ trained to work with equipment and machinery. Once work has been completed all plant, material and equipment is to be removed. Stock stored on site shall be under cover and protected from moisture. Products stored in excess of three months shall not be used unless authorised.

Contractor to provide their own resources to secure security of tools, materials, and machinery/equipment that will be stored on site. Employer will not be liable to account for any costs related to damages or thief of Contractor's tools, materials, and machinery and equipment.

6.3 Specifications

All materials, road signs and markings, methods, equipment and tests to be in accordance to accordance with SABS 1200M, South African National Standards (SANS), Committee of Land Transport Organization(COTLO), Technical Recommendations for Highways (TRH) series as well as Technical Methods for Highways (TMH)series where applicable.

6.4 Inspections

Site supervision as per construction regulation 2014, routine checks and inspections to be conducted as per Contractor's defined QCP intervention assessment points. New pavement layers to be constructed only once underlying layer has been approved.

The following should be recorded during repairs: -

- a. Areas where pavement conditions changed from the documented pavement conditions with a description of this change.
- b. Any non-routine tests that must be conducted.
- c. All site instructions and decisions made.
- d. Repair conditions.

The following should be noted during the repairs;

- a. Hot-mix designs to be produced with acceptable tolerances of binder content and aggregate grading.

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- b. An optimum moisture content for compacting to be maintained.
- c. Stabilizing agents to be mixed in immediately after each application.
- d. Stabilizing agent to be applied throughout the whole area at a continuous rate of application and care to be taken during mixing to ensure it is not mixed deeper than the required depth.
- e. The crushed stone base stabilized with bituminous emulsion shall be mixed, placed and compacted within 5 hours.
- f. The crushed stone base stabilized with ordinary Portland cement shall be mixed, placed and compacted within 8 hours.
- g. Tack coats to be applied within 24 hours of surfacing or allowable timelines as per the standard/specification indicated on the datasheet
- h. All pavement layers to be laid and compacted uniformly
- i. All materials shall be spread evenly over the entire surface which is to be compacted, and filled with a quantity which will comply with the specified required thickness after compaction
- j. Where applicable the material to be thoroughly mixed to obtain an even mix of the several types of materials and to spread fine and course material evenly throughout the mixture
- k. All compacted surface layers should be level with the road surfaces, extending slightly onto the sound adjacent area. There should not be bumps or hollows within the repair patch
- l. Weather conditions and ambient temperature ($>10^{\circ}\text{C}$ for repairs) to be recorded daily. Work shall not commence in wet, windy or freezing conditions or when the moisture content is more than 50% of the optimum moisture content or any other conditions which will hinder the properties of the materials or setting/curing of the works

6.5 Quality Control and Assurance

The Contractor shall develop and implement a system for quality verification records, including but limited to: Quality Assurance Plan, Quality Control Plan/Inspection Test Plans, Inspection Checklists, Record Books (Data Books) as specified in the Tutuka Quality Specifications.

The Contractor shall produce and submit a method statement, project quality plan/programme, EMP, and QCP to the Employer for acceptance one week before work commences. The QCP must indicate relevant hold, surveillance and witness points to be agreed upon by the EDWL System Engineer.

The Contractor to produce a map, sketch or drawing once repair work has been completed. Document to be submitted to the Employer for acceptance before the next area is repaired and any payment is made. This document must include any variation which has been observed during repairs, as opposed to the expected pavement conditions. The map, sketch or drawing to indicate the location of the repair, the square area together with the quantity of materials which was utilized for the repair.

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7. Documentation Management and Configuration Management

7.1 Document Management

All documents supplied by the Contractor shall be subject to Eskom's approval. The language of all documentation shall be in English. The Contractor shall include the Employer's drawing number in the drawing title block. This requirement only applies to design drawings developed by the Contractor and his Subcontractors. Drawing numbers will be assigned by the Employer as drawings are developed.

7.1.1 Document Identification

The Contractor is required to submit the Vendor Document Submission Schedule (VDSS) as per agreed dates to the delegated Eskom Representative. Eskom will pre-allocate document numbers on the VDSS and send back to the Contractor through the delegated Eskom Representative. The VDSS is revisable and changes must be discussed and agreed upon by all parties. Changes in the VDSS can be additional documentation to be submitted, changes in submission dates or corrections in documentation descriptions, document numbers, etc. The Contractor's VDSS shall indicate the format of documents to be submitted.

7.1.2 Document Submission

All project documents must be submitted to the delegated Eskom Representative with transmittal note according to Project / Plant Specific Technical Documents and Records Management Work Instruction. In order to portray a consistent image it is important that all documents used within the project follow the same standards of layout, style and formatting as described in the Work Instruction. The Contractor is required to submit documents as electronic and hard copies and both copies must be delivered to the Eskom Representative with a transmittal note. All soft copy formats to be compiled on Microsoft Word/PDF for Windows 2007 or 2010. All test documentation to be submitted in a file.

In addition, the Contractor shall be provided with the following standards which must be adhered:

- Documentation Management Review and Handover Procedure for Gx Coal Projects[9]
- Project Documentation Deliverable Requirement Specification
- Technical Documentation Classification and Designation Standard

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7.2 Document Returnables

The contractor shall produce and submit a project plan, project quality plan, organogram, detailed method statement, QCP, safety file for approval prior to the commencement of work. The Contractor to conduct induction and medicals prior to commencement of work.

These documents should contain the following information, which is not limited to -

- Project Programme: Indication of the different activities applicable for the execution of the required works from site establishment to handover as well as the time period allocated for each activity
- Project Quality Plan: Highlight the activity or standard which shall be used to ensure quality materials and workmanship
- Organogram: Indication of the core staff (i.e. Professional Civil Engineer, Site Manager/Project Manager, Safety Officer, etc.) who will be involved in the execution of the required works. Names and qualifications to be specified.
- Method Statement: Detailed method statement specifying sequence of activities, skills, labour, materials, tools, equipment, machinery and testing procedures applicable for the execution of the required work.
- QCP: Must indicate relevant hold, surveillance and witness points for the Contractor and Employer
- Drawing format for all drawings to comply with the latest revision of Engineering Drawing Standard (240-86973501)
- EMP: Must indicate control measures that will be applied during execution of the works to prevent environmental impact
- Risk assessment list all risks for the works to be submitted prior to execution of works.

7.3 Drawings Format and Layout

Contractor to submit as built drawings for the pavement and drainage design. The Contractor shall include the Employer's drawing number in the drawing title block. This requirement only applies to design drawings developed by the Contractor and his Subcontractors. Drawing numbers will be assigned by the Employer as drawings are developed. The creation, issuing and control of all Engineering Drawings will be in accordance with the latest revision of Engineering Drawing Standard(240-86973501). Drawings issued to Eskom will be a minimum of one hardcopy and an electronic copy. The Contractor is required to submit electronic drawings in Micro Station (DGN) format, and scanned drawings in PDF format. No drawings in TIFF, AUTOCAD or any other electronic format will be accepted. Drawings issued to Eskom may not be "Right Protected" or encrypted.

7.4 Handover Requirements

All Documentation and Data books shall be completed, delivered and approved when the Contractor applies for final inspection at repair completion and handed over to the Employer at takeover application.

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7.4.1 Data Books

Data Books shall be maintained by the Contractor to substantiate conformance to product specifications and requirements. All records shall be safely stored (easily retrievable) following the final completion of the works at takeover. These records shall include as a minimum:

- Quality Management documentation
- Purchased product and material data sheets and delivery notes with batch number
- Testing and laboratory results
- Survey Reports
- Approved and Accepted Method Statements
- Signed Quality Control Plan
- Map indicating the location and quantity of repairs
- As built drawings

8. Programme

The Contractor is to submit a detailed program of the works 1 week after being awarded the contract. The programme must clearly demonstrate to complete the works in the shortest time possible, effective from the order/contract appointment. The program submission must be in soft copy pdf.

The project programme to specify the different activities applicable for the execution of the required works from site establishment to handover as well as the time period allocated for each activity.

9. Acceptance

This document has been seen and accepted by:

| Name | Designation |
|----------------------|------------------------------------|
| Phathamandla Sithole | Civil Engineering Manager |
| Obert Matodzi | Civil Engineer |
| Riaan Venter | Senior Civil Engineer |
| Kebebe Moiloa | Project Manager |
| Nikiwe Kulu | Project Manager |
| Ntombifuthi Ngcobo | Engineering Manager |
| Lele Masote | Engineering Manager |
| Myke Banda | Civil Engineering QC |
| Monika Mokgawa | Environmental Manager |
| Thokozani Maseko | Safety Manager |
| David Sindane | Senior Advisor Quality Engineering |
| Lyborn Xivambu | GMR2 Compliance Manager |
| Puleng Khabo | Risk & Assurance Manager |

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10. Revisions

| Date | Rev. | Compiler | Remarks |
|------------------|------|-----------|-------------------------------------|
| May 2020 | 0 | I Naidu | First draft for review and comments |
| August 2020 | 1 | I Naidu | Final Document for Issue |
| July 2021 | 2 | N Dlamini | Amended Final Document for Issue |
| 26 January 2024 | 3 | I Patel | Revised and Submitted for Review |
| 13 February 2024 | 4 | I Patel | Final Document for Issue |

11. Development Team

The following people were involved in the development of this document:

- Imraan Patel
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- Nompumelelo Dlamini

12. Acknowledgements

- Francois Streicher

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Appendix A

N/A

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