

SCOPE OF WORK

Tender No.: T093-23

Description: Refurbishment of E & F Flotation Bank Building - Structural Steel & Concrete

TENDER PRE-QUALIFICATION:

- The main bidder should have previous proven experience of successfully executing Concrete works (Exceeding 100 m³) and Structural (exceeding 100 tons) Refurbishment / Repair work inside a continuously operating production plant in mining environment.
- CIDB Rating - The Main Contractor or JV should have a minimum of CIDB 7CE or 7SL

INVITATION TO TENDER

This document prescribes the requirements for the Structural (Steel & Concrete) Rehabilitation and Refurbishment of the E & F Flotation Bank.

1.2 SCOPE BACKGROUND

Foskor require the Structural Rehabilitation of the E & F Bank Flotation Building, with the building showing significant structural deterioration.

The rehabilitation will take the form of:

- *Column strengthening between pump floor and flotation floor*
- *Flotation floor refurbishment and strengthening by means of steel beams*
- *Support of tank cell beams by means of steel beams and steel columns*
- *Refurbishment of existing flotation tanks, walkways and other access and safety infrastructure*
 - *Various concrete repair elements*

1.3 COMPANY BACKGROUND

Foskor is one of the world's largest producers of phosphate rock (concentrate) and phosphoric acid. It is one of the world's few vertically integrated producers of phosphoric acid and is the second largest supplier to India, the world's largest consumer of phosphoric acid.

The Company owns and mines phosphate resources and beneficiates the mined material to produce a phosphate concentrate at Phalaborwa, in the Limpopo Province of South Africa. The phosphate concentrate is sold locally and also transported to the Richards Bay plant on the coast of Kwa-Zulu Natal to produce phosphoric acid, sulphuric acid and granular fertilisers MAP and DAP from phosphoric acid and is the leading supplier of fertilisers to South Africa. In all about 95% of the phosphoric acid is exported and the granular sales are divided between exports and local markets. Since 1951 Foskor has supplied more than 95% of South Africa's fertiliser requirements.

2. SCOPE OF WORK

2.1 BACKGROUND DOCUMENTATION

N/A

2.2 SCOPE - EXTENT OF WORK OR SERVICE REQUIRED

2.2.1 General Scope Considerations:

Please allow for a competent Quality Control Officer to ensure that quality of the deliverables complies to the relevant specifications & standards. In the event of quality system failures, Foskor will request the Quality Official's experience and qualifications and if this is not acceptable, it will be expected that the contractor obtain this service at its own cost.

2.2.2 Project costing and expenses

2.2.2.1 The contractor shall supply all engineering services, materials, labour, transport, supervision, and consumable materials, equipment, tools and each and every item of expense in order for the scope of work to be completed successfully unless otherwise stated taking the following into consideration

2.2.2.2 Disposal of refuse

The Contractor shall be responsible for disposal of refuse and waste generated by his staff on a daily basis. The site is to be kept clean, neat and tidy, by complying to Foskor Waste Management COP

2.2.2.3 General requirements for commissioning

Commissioning or handover will be executed as per Foskor Procedures or as directed by the Engineer. Normally the Foskor Punch list and Hand over certificate will be used.

2.2.2.4 Scope Specific statutory and legislative requirements Legislative requirements

The successful service provider shall ensure that all work is carried out in accordance with the following specifications and requirements.

The successful or appointed service provider shall comply with:

- i. COLTO (1998).
- ii. All the parameters mentioned under the heading number "16. PARAMETERS" of this document

2.2.2.5 The successful or appointed service provider shall comply with the latest revision of all applicable Foskor CTD's (Critical task Descriptions) (CTD's are available on request):

2.2.2.6 Sub-contracting

Critical/ Major portions or the full scope of the work may not be subcontracted

2.2.2.7 Progress Report

Projects - A Progress report needs to be submitted weekly of every second week to the respective project engineer or project leader. This will form the basis for Invoice certificates and Invoice approvals in conjunction with the relevant Bill of Quantities. No invoice shall be approved without the BOQ

PROGRESS REPORT INDEX – Typical

1. SHREQ
 - Safety issues, Environmental, etc
2. Compliment
 - Trades, Qty, Hours, etc
3. Progress
 - Planned versus actual
 - Activities completed or milestones
4. Activities
 - Task completed, milestones
 - Technical issues
 - Quality Control
5. Drawings
 - Drawing issued
 - Drawing issues
6. General
7. Concerns, If Any
8. Photos / Videos of site and progress

2.3 SCOPE

2.3.1 SAFETY - Training and authorisations - Summarised - Typical but not limited to

1. Basic Health and Safety – Training
2. First aid - Training
3. HIRA – Training and Authorisation
4. TMM – Foskor driving licence, open pit licence and Authorisation
5. Confined space – Training and Authorisation
6. Working at Heights – Training and Authorisation
7. Hot Work- Training and Authorisation
8. Conveyors - Authorisation
9. Electrical – Relevant training and Authorisation
10. Lifting and rigging – Training and Authorisation
11. Overhead crane - Training and Authorisation
12. Fire – Training
13. Other – as and when as per Foskor COP's

2.3.2 SCOPE OF WORKS - STATEMENT OF WORK REQUIRED

This work entails the rehabilitation and strengthening of the structural steel & reinforced concrete components of the *E & F Bank Flotation Building*.

Refer Section 3 Project Urgency for description of Stages 1 to 4.

Rehabilitation Operations

Reference should be made to the relevant tender drawing sheets, specifically sheet 2. The operations consist of the following:

- Column Strengthening between pump floor and flotation floor
- Refurbishment and strengthening of the flotation floor
- Installation of steel support columns above flotation floor
- Installation of support beams for the tank cell beams
- Dust Prevention and Suppression
- General rehabilitation

Each operation is broken down in the tasks listed below. They can and should be executed concurrently where possible to speed up construction. The Contractor should familiarize himself with the existing services which may influence the timing and execution of the works.

Possible clashes between new and existing infrastructure are foreseen. These should be coordinated with Foskor and programmed accordingly. The foreseen clashes are indicated on the relevant drawing sheet with a proposed generic solution. During construction, the Contractor should measure and prepare a methodology of how each potential clash will be resolved for approval by the Engineer.

Below is the suggested methodology taking into account the constraints presented in Section 3: Project Urgency – Access/Production requirements

Operation 1: Site establishment and General

- Complete all site access and work permit requirements
- Prepare and place dust mitigation and safety measures
- Measurements for the installation of steel columns and beams
- Prepare shop drawings for steel installations
- Survey of existing services around columns for relocation purposes
- Coordinate relocation of services with FOSKOR
- Clean and prepare columns for strengthening
- Place working platforms to access columns at height
- Execute relocation of services around columns
- Prepare and approve method statements for strengthening of each column
- Develop QMS / method statements, health and safety and risk assessments
- Establish and report to the engineer any further possible clashes on site

Operation 2: Lower columns strengthening: East side

- Remove existing angles on column corners
- Drill and epoxy starter bars for column thickenings in floor
- Place reinforcement for columns
- Erect shuttering for columns
- Cast and cure concrete for columns
- Painting of protective coating on thickened columns
- Remove shuttering for columns

Operation 3:

Upper columns strengthening: East side

- Place working platforms to access columns at height

- Clean concrete columns
- Repair concrete in columns where damage is evident
- Fix steel angles and flat bars around the columns
- Treat and paint steel work
- Reinstate services around repaired columns

Lower columns strengthening: West side

- Remove existing angles on column corners
- Drill and epoxy starter bars for column thickenings in floor
- Place reinforcement for columns
- Erect shuttering for columns
- Cast and cure concrete for columns
- Painting of protective coating on thickened columns
- Remove shuttering for columns

Operation 4:

Primary and Secondary Steel beams under upper flotation floor: East Side

- Erect working platforms to access soffit of flotation floor
- Clean concrete where brackets are to be fixed
- Repair concrete in flotation floor soffit where damage is evident
- Fix steel secondary beams (in sections) to flotation floor soffit
- Fix primary beams to columns and secondary beams (in sections)
- Treat and paint steel work
- Disassemble platforms

Upper columns strengthening: West side

- Place working platforms to access columns at height
- Clean concrete columns
- Repair concrete in columns where damage is evident
- Fix steel angles and flat bars around the columns
- Treat and paint steel work
- Reinstate services around repaired columns

Operations 2 - 4: (Independent of other operations)

Secondary Steel beams under lower flotation floor: East side

- Erect working platforms to access soffit of flotation floor
- Clean concrete where brackets are to be fixed
- Repair concrete in flotation floor soffit where damage is evident
- Fix steel secondary beams (in sections) to walls/beams and flotation floor soffit
- Treat and paint steel work
- Disassemble platforms

Following completion of all strengthening at pump floor and below flotation floor level on East side, work may now commence above flotation floor on East Side.

Operation 5:

Steel columns above flotation floor: East Side

- Place working platforms to access soffit of tank cell beams
- Clean concrete where brackets are to be fixed
- Fix column plates to flotation floor beams
- Fix columns to base plates

Primary and Secondary Steel beams

under upper flotation floor: West Side

- Erect working platforms to access soffit of flotation floor
- Clean concrete where brackets are to be fixed
- Repair concrete in flotation floor soffit where damage is evident
- Fix steel secondary beams (in sections) to flotation floor soffit
- Fix primary beams to columns and secondary beams (in sections)
- Treat and paint steel work
- Disassemble platforms

Operations 3 - 5: (Independent of other operations) Secondary Steel beams under lower flotation floor: West side

- Erect working platforms to access soffit of flotation floor
- Clean concrete where brackets are to be fixed
- Repair concrete in flotation floor soffit where damage is evident
- Fix steel secondary beams (in sections) to walls/beams and flotation floor soffit
- Treat and paint steel work
- Disassemble platforms

Following completion of all strengthening at pump floor and below flotation floor level on West side, work may now commence above flotation floor on West Side

Operation 6:

Propping: East side

- All beams to be propped from pump floor to flotation floor

Steel columns above flotation floor: West Side

- Place working platforms to access soffit of tank cell beams
- Clean concrete where brackets are to be fixed
- Fix column plates to flotation floor beams
- Fix columns to base plates

Operation 7:

Steel beams above flotation floor: East side

- Clean concrete where brackets are to be fixed
- Fix cell support beams in position

Propping: West side

- All beams to be propped from pump floor to flotation floor

Operation 8:

Beam Grouting: East Side

- Grout voids between steel beams and existing concrete works
- Disassemble platforms
- Clean and paint top of 1st floor concrete with a protective coating

Steel beams above flotation floor: West side

- Clean concrete where brackets are to be fixed
- Fix cell support beams in position

Operation 9:

Beam Grouting: West Side

- Grout voids between steel beams and existing concrete works
- Disassemble platforms
- Clean and paint top of 1st floor concrete with a protective coating

Operations 5 - 9:

General rehabilitation: Bank E&F

- Refurbish other structural items as directed by the Engineer
- Refurbish other structural items as directed by the FOSKOR
- Refurbish other mechanical & electrical items as directed by the FOSKOR

Operation 10:

Cleaning site & de-establishment

- Remove all dust screens and protection measures
- Clean site

3. PROJECT URGENCY

Project urgency is defined below:

This is a Project that impacts production and will need to be conducted as follows to mitigate production impact.

Access/Production Requirements:

The Eastern (E Bank) side of the building has currently 1 line operational out of a possible 3 lines. The Western (F Bank) side has 3 lines operational out of 3 available.

The access and production requirements are that:

- The pump floor always remains operational
- Work will commence on the Eastern side, with the two E Bank lines to be made operational first, once structural strengthening below them is completed
- 5 production lines are always available and operational.
- The building is divided into an Eastern and Western side by central expansion joint. All columns and flotation floor strengthening are to be completed on the Eastern side before commencement with support works above the flotation floor on that side, and similarly for the Western side.
- The completed building has 6 lines available for operation

The Contract completion is estimated to be within 9 months.

Allowable lay down areas are the existing C and D bank building.

Proper communication and plant take down procedure to be managed by contractor and reported daily to the production meeting.

4. **DELIVERY OF MATERIALS AND EQUIPMENT**

It is the responsibility of the Contractor to take delivery, off-load, store and move into their permanent position all equipment and materials covered under this Scope. The Contractor shall, at his own expense, be responsible for the delivery to the Site of imported plant and equipment, materials and Contractor's plant and equipment in connection with the execution of the works, including but not limited to securing of permits and customs clearances, and payment of handling costs, storage costs, releasing costs, transportation costs, and duties, taxes, imposts, excise and charges of any kind that may be imposed by the South African Government, or any of its agencies and political subdivisions relating to the supply and delivery to the site of the imported plant and equipment, materials and Contractor's plant and equipment.

TAKE NOTE - Foskor pays for material delivered to Foskor site only!

NB: The contractor/ consultant must clearly state in his tender submission if there is an exclusion on the Foskor scope (As per the site meeting procurement scope and site meeting minutes) Failure to state the exclusion will mean that the full Foskor scope is still applicable.

Lay down areas are as indicated on the drawings

5. **BATTERY LIMITS – INCLUSIONS AND EXCLUSIONS**

Areas within the building will be allocated to the Contractor in stages to allow for the execution of the work. These areas will coincide with the phases of the project and will be communicated to the Contractor prior to commencement of each phase. Upon commencement the Contractor should clearly mark these defined limits and also provide for dusk mitigation and safety nets to allow for normal operation of the remaining part of the plant as throughout the project remaining part of the E & F bank floatation plant will be active.

External lay-down areas will also be provided for the placement, storage and refurbishment of equipment removed from the building.

This table define the responsibilities for the contractor and Foskor. Take note the contractor needs to accommodate all these aspect in his pricing.

| WHO WILL SUPPLY THE FOLLOWING? | | | | | |
|---|---|-----------------------|---|---------------------------------|----|
| N/A = NOT APPLICABLE C = CONTRACTOR FF = FOSKOR, FREE OF CHARGE FC = FOSKOR, AT COST TO CONTRACTOR | | | | | |
| | | | | | |
| 1. Sanitary – | | 2. Transport – | | 3. Electrical – | |
| 1.1 Water on site and toilet facilities / janitorial services | C | 2.1 Labour | C | 3.1 Generators | C |
| 1.2 Potable connection point | C | 2.2 Materials | C | 3.2 Electrical Extensions | C |
| 1.3 Connection to construction water supply | C | 2.3 Equipment | C | 3.3 COC Site Establishment | C |
| 1.4 Change rooms | C | 2.4 All TMMS | C | 3.4 Temporary lighting | C |
| | | | | 3.5 Electrical connection point | FF |

| | | | | | |
|--|--|--|--|--|---|
| | | | | 3.6 Connection to Electrical supply | C |
| | | | | 3.7 Electric panel + distributing wiring | C |
| | | | | 3.8 Power for tools on site for existing Foskor electrical supply point (Welding plugs and 220v plugs) | C |

| WHO WILL SUPPLY THE FOLLOWING? | | | | | |
|---|---|---|---|--|----|
| N/A = NOT APPLICABLE C = CONTRACTOR FF = FOSKOR, FREE OF CHARGE FC = FOSKOR, AT COST TO CONTRACTOR | | | | | |
| | | | | | |
| | | | | 3.9 Electrical and Instrumentation Installation | FF |
| 4. Quality – | | 5. Security – | | 6. Lifting and Rigging – | |
| 4.1 Plan, Management, QA, QC | C | 5.1 Site Security | C | 6.1 All rigging equipment (Slings, Chain blocks, turfers, etc) | C |
| 4.2 All quality test Civil, Paint, Mechanical, etc | C | 5.2 Foskor ID Card | C | 6.2 Rigger | C |
| 4.3 Sampling and laboratory testing | C | | | 6.3 Mobile cranes and fixed cranes | C |
| 7. Medicals - | | 8. Communication devices – | | 9. PPE – | |
| 7.1 Entry and Exit | C | 8.1 Supply all communication devices like laptops, computers, networks, radios, cellphones, etc | C | 9.1 Supply, Issue, inspect and manage | C |
| 7.2 First aid box at place of work | C | | | | |
| 10. Site Surveys – | | 11. Safety File - Foskor will issue template | | 12. Training & Authorizations | |
| | C | Ensure file conform/ populate to Foskor standards | C | 12.1 All Required Training | C |
| | | | | 12.2 Authorisation - As per Foskor COP | FF |

| 13. Site Establishment – | | 14. Waste management on site – | | 15. Painting - | |
|---|----|---|---|--|----|
| 13.1 Site office/s with suitable facilities for daily “Green Area” meetings, and lunch area | C | 14.1 Transport all waste to Foskop designated waste sites | C | 15.1 Supply all equipment and tools paint, labour, etc. | C |
| 13.2 Site establishment space | FF | | | | |
| 16. Scaffolding | | 17. Labour | | 18. Compressed air | |
| 16.1 Scaffolding Supply & Erect** | C | 17.1 All labour as per Scope of Work to execute task including management | C | 18.1 Sandblasting or flash blast | C |
| 16.2 Scaffolds be managed by the Contractor | C | | | 18.2 Compressor | C |
| WHO WILL SUPPLY THE FOLLOWING? | | | | | |
| N/A = NOT APPLICABLE C = CONTRACTOR FF = FOSKOR, FREE OF CHARGE FC = FOSKOR, AT COST TO CONTRACTOR | | | | | |
| | | | | | |
| 16.3 Cherry Picker’s – only if and when available by pre booking | FF | | | 18.3 Air for power tools - If available | FF |
| 16.4 Cherry Picker’s Driver– Trained and authorized driver | C | | | | |
| 19. Fuel | | 20. Storage and inventory control | | 21. Consumables | |
| 19.1 Fuel Supply | C | 20.1 Protective coverings/tarpaulins | C | 21.1 Welding rods | C |
| 19.2 Fuel storage | C | 20.2 Storage area and inventory control | C | 21.2 Bolts & Nuts | C |
| 19.3 Fuel fire protection | C | | | 21.3 Etc | C |
| 19.4 Refuelling | C | | | | |
| 22. Tools & Equipment - | | 23. Certificates - | | 24. Training - | |
| 22.1 All Portable electrical Equipment | C | 23.1 Supply All certificates as required | | 24.1 All required training and training manuals as required to ensure that Foskop can train its workforce and operate the plant / equipment safely | C |
| 22.2 Hot Work Equip as per Foskop COP - Welding Machines, Gas Cutting, Grinding, Gauging, etc | C | | | 24.2 All manuals and related documents to be supplied to project Eng and Foskop Drawing office for safe keeping | C |

| | | | | | |
|--|---|--|--|--|--|
| 22.3 Tools as required to execute task | C | | | | |
|--|---|--|--|--|--|

****NOTE**

Although Foskop usually supply scaffolding free of charge the size and nature of the works pre-clude this, and contractor is to supply their own scaffolding.

It should be noted that FOSKOR have an existing appointed and accredited scaffolding supplier who could be subconsulted and provide part of the local company requirement of the contract.

5.1 Additional Boundaries

Contractor to take note of allowable working times and plan accordingly. The normal work hours are from 7am to 4pm, contractor may work to 6pm upon application and granting of permission but at no point exceed gazetted allowable working hours as per Mine Health & Safety Act.

6. AS BUILT DRAWINGS

As built drawing requirement is defined below

As built drawings are to be compiled after completion

Note! – All drawings to be delivered in AutoCAD electronic format. All drawing to be detail engineering drawings

7. QUALITY

- i. The service provider must provide the necessary quality management systems and plans to ensure that the quality of his work complies with the requirements of this scope of work
- ii. The service provider shall during all phases of construction comply with the Foskop approved Quality Assurance Plan
- iii. The service provider shall be responsible for all the resources required for executing the Quality Management System including but not limited to, developing the Quality Assurance Plan & performing the Quality Control measures to ensure that the deliverables comply to the specifications & standards mentioned in the scope of work
- iv. Any change requests / additional work resulting due to inadequate quality management system will be to the account of the service provider
- v. Foskop might appoint a third party for Quality Control Inspections
- vi. The Service provider will have to provide an approved quality system for all work executed.
- vii. This will include the following but is not limited to:
 - a. Quality plan
 - b. Quality compliance – Performance and reports
 - c. Quantity surveying
 - d. Quality Assurance
 - e. Quality Authorization matrix – part of Quality plan
 - f. Quality control
 - g. Quality administration. – All documents, checks, measurements, reports, variances, analysis, Corrective actions, etc. needs to be properly filed and available on request at any time. The file will require an index
 - h. Includes all test work, laboratories, Filing, etc.
 - i. Survey and survey verifications
 - j. Construction versus design - Any Deviations from the approved “Construction Drawings”
 - k. Quality communication – What needs to be reported to whom and at what frequency
- viii. Foskop envisage a complete quality System driven by the Service provider and this system

- / plan will be approved by Foskor and the appointed designer (if applicable) before construction/fabrication will be started.
- ix. Compliance to this plan will be measured and failure to adhere to the quality plan will result in the stopping of construction activities until concerns have been addressed. The cost for this delay will be for the service providers' account.
 - x. Foskor may appoint a third part to measure and control Foskor's interest in the terms of quality in this contract and the service provider is expected to work in conjunction with this company
 - xi. Hold points will be discussed and finalized with the successful service provider based on the approved Quality plan

The Quality plan will only be compiled and signed off after the Method Statement and WBS* have been compiled

Quality on Shutdown type tasks will be included in the Scope of Works but the service provider will have to submit proof of a experienced quality assurer or relevant qualifications. IF the service provider does not have this it will be required that this service be hired in by the service provider at his cost.

- i. State any specify hold points that is not negotiable here
- ii. State any other quality that is applicable that is not in the "Parameters" section

Method statement – the service provider must list all steps and actions required to complete the work as per the scope of work – typically includes the items listed below:

- i. Key step and stages of the work required
- ii. Tools, Equipment, TMMS, etc
- iii. Labour requirements, etc
- iv. Spares, resources,
- v. Safety requirements

***WBS** is a hierarchical and incremental decomposition of the project into phases, deliverables, and work packages. It is a tree structure, which shows a subdivision of effort required to achieve an objective, for example a program, project, and contract.

This includes arrangements, tools, equipment labour, Tasks, Purchase, Quality, Communication, etc

7.1 Quality file index

The quality file index listed below will be the minimum requirement.

This file must be kept up to date for the duration of the project and will be handed in to the Foskor project Engineer on completion of the project

QUALITY FILE INDEX

File Index

1. Issued for Construction (IFC) drawings - Approved
2. Quality Control Plan (QCP) Approved
3. Competency of People – Welder Qualifications, Trade, Authorization, Certifications, etc
4. Designer/Engineers Instructions, Specifications, Approvals, Concessions applied for & approved. Site instructions, Variations and ECO's
5. Method Statement of contractor– Approved
6. Material orders & Delivery notes

7. Certificates – Material, Data Sheets, Compliance, Certification, etc
9. Test Results – Each Discipline – Test cubes, NDT, etc
10. Request for inspection (RFI)
11. As Built Drawings
12. Reports - Survey, etc
13. Punchlist/Snag list
14. Handover/ Occupations/ Taking over Certificates/Commissioning

7.2 Additional Quality Requirements

Quality requirements are as those defined in the specification and COLTO (1998) documentation

Additional Quality requirements - None

8. **PROJECT DELIVERABLES**

8.1 The deliverables for this project include:

A partially reconstructed and rehabilitated E & F Bank Building.

8.2 Data Books

During the official handover, the service provider shall submit a detailed DATA BOOK that shall contain the following documents and information:

- a) Certificates and documents indicating welding procedures and standards used, material grade certificates and the qualifications of welders and workmen used in the construction.
- b) Comprehensive NDT (Non-Destructive Testing) report, including name and registration number of inspector

indicating that all welds, joints, and high stress points have been examined and are free from defects and cracks.

- c) All certificates, documents, and records to be cross referenced for purposes of traceability

NB! ALL CERTIFICATES AND DOCUMENTS MUST BE CROSS-REFERENCED

8.3 Manuals and Documentation

The following must be supplied: None

8.4 Format of Documents and Manuals

Note! - All Manuals/Documents must be in English

8.5 Transmittal of Documents and Manuals

Documents and Manuals to be submitted in the flowing formats:

| Type of Document | Hard Copy | Electronic Format |
|------------------|-----------|-------------------|
| Manuals | X | X |
| Drawings | X | X |
| Reports | X | X |
| Data Books | X | X |

Hard Copy: Book or binding arch file format and must be durable and of high quality.

Soft Copy: Manuals, Reports and Data Books – Word, Excel, PDF, etc.

Drawings – AutoCAD and delivered

Storage – Compact Disk or Data traveller

Language: English

9 DOCUMENTS / DRAWINGS ISSUED BY FOSKOR

| Drawing or Document No | Title | Revision |
|------------------------|--------------------------------|----------|
| 301-00707/01-01 | SITE PLAN 1 | B |
| 301-00707/01-02 | SITE PLAN 2 | B |
| 301-00707/01-03 | SITE PLAN 3 | B |
| 301-00707/01-04 | SITE PLAN 4 | B |
| 301-00707/01-05 | COLUMN STRENGTHENING | B |
| 301-00707/01-06 | FLOTATION FLOOR SUPPORT 1 | B |
| 301-00707/01-07 | FLOTATION FLOOR SUPPORT 2 | B |
| 301-00707/01-08 | CELL BEAM SUPPORT 1 | B |
| 301-00707/01-09 | CELL BEAM SUPPORT 2 | B |
| 301-00707/01-10 | CLASHES OF SERVICES 1 | B |
| 301-00707/01-11 | REHABILITATION METHODOLOGIES | B |
| Note | Please read your Scope of Work | |

10. ON-SITE SUPERVISION REQUIREMENT

- A FOSKOR work permit before commencement of site work.
- A full time 2.9.2 appointed supervisor will be on this site for the entire duration of site work
- A 2.6.1 appointed site manager for overall site management

10.1 Additional Requirements - None

11. TENDER DELIVERABLES

The deliverables will include: -

- Complete Foskor pricing schedule (BOQ)
- Preliminary Project Schedule
- Preliminary method statement to execute the site work
- Company training Matrix indicated minimum training requirement compliance, or the tenderer should provide undertaking to comply with Foskor Safety requirements during tendering stage and fulfil the requirements if awarded the work. Any deviation may lead to cancellation of order/contract. Timeframes needs to be attached
- Tax Clearance
- Letter of Good standing (Workman compensation)
- BEE Certificate
- Commercial documents requested by Procurement
- Not submitting the required documentation or not completing the documentation (Pricing Schedule) correctly will lead to a disregard of the tender.
- Take note of the tender evaluation documents that needs to be submitted

12. SAFETY

Service provider to refer to the full and updated Foskor COP's available:

- The service provider and subservice providers need to comply with the Mine Health and Safety act at all times. All Foskor COP's Policies and procedures needs to be adhered to.
- A service provider 2.9.2 to be permanently on site.
- Medical, Induction, Foskor ID Card, etc. is approximately R800 per Person. Exit medicals need to be done at termination of contract.
- The Successful tenderer will be required to compile a Foskor Work permit and at least 2 weeks should be allocated for this. The service provider must provide the following appointed persons in terms of the MHSA: 2.6.1; 2.9.2 and Section 29(1) – SHE REP for the duration of the contract
- All vehicles and cranes and other TMM's to be inspected before entering Foskor Premises.
- All person competencies to be verified before being allowed to work on Foskor premises for a specific task.
- The service provider must compile a Safety File as per Foskor standard for all service providers and sub-service providers
- Site access will need to be controlled and all persons must receive site specific induction before entering the site.
- Conduct inspections as per Foskor Safety System. Analyse data and trends and recommend preventative measures where required
- Ensure all authorizations are in place as per the Foskor Safety System. Arrangement with Foskor training to be done by the service provider to ensure that authorization and training is conducted. Arrange timeously.
- Ensure all workers competencies are available and have been validated.
- Ensure proper security, sign boards, fencing and barricading is in place on site where applicable
- The service provider shall in general comply with the FOSKOR General Engineering Specifications, COP's, latest revisions, and all relevant regulations
- The service provider

must complete a Baseline Risk Assessment (COP 01) before a work permit can be issued for the installation.

xv. All service providers not in possession of a valid Foskor ID card must complete the Foskor induction course and have to undergo a medical examination at the Foskor clinic for the service provider's account
 xvi. The service provider shall be responsible for coordinating and integrating his schedule and responsibilities with other FOSKOR appointed contract manager on site for this Scope of Work.
 xvii. All personnel operating mobile equipment including LDV's must have a Foskor driver's permit.

xviii. An open Pit Licence is required for driving in the mining area's xix.

All the required PPE and Safety Equipment are for the service provider's account.

- xx. All service providers must ensure that:
 - a. His workers are issued with the correct personal protective equipment free of charge.
 - b. That the workers wear the PPE in accordance with the project area's requirements or as given by the service provider Supervisor.
 - c. Training is provided in the correct use of PPE to workers.
 - d. Daily inspections are done on PPE.
 - e. The registers will be complete at least monthly on findings on PPE. (All PPE must be kept in good condition)
- xxi. All providers of services need be informed of the following minimum training is applicable to all service providers (irrespective of the tasks or scope of work) that will enter Foskor Phalaborwa site with effect from 1 April 2014. This training is not presented by Foskor Training section and service providers must ensure that the training is sourced through accredited external training companies:
 - a. Basic health and safety principles
 - b. HIRA
 - c. First Aid Training
- xxii. All other training requirements must be aligned with the baseline risk assessment. Risks identified in the baseline risk assessment will guide the requirements for training. A summary of the training must be completed as well as status on required authorization as per Foskor COP's.
- xxiii. Training certificate will be accepted if complying to the following:
 - a. Unit Standard Title
 - b. Learner Full name
 - c. Learner ID number
 - d. Competency achieved
 - e. Date of Assessment
 - f. Assessor's signature
 - g. Training provider logo
 - h. Training provider registration number and accreditation number.
 - i. Seta logo

13. LEGISLATIVE REQUIREMENTS – SUMMARY

13.1 Minimum Legislative Requirements:

The successful or appointed service provider shall comply with:

- i. The Mines Health and Safety Act with Regulations (Latest revision)
- ii. The National Road Traffic Act with Regulations (Latest revision)
- iii. All applicable national and international legislative requirements and regulations.
- iv. Foskor (Pty) Ltd. COP (Code of Practise) No. 25 for Service provider Control (Available on request)
- v. Foskor (Pty) Ltd. COP (Code of Practise) No. 59 for Trackless Mobile Machinery (Available on request)
- vi. All Foskor (Pty) Ltd. safety, health, quality, and environmental procedures applicable to the successful application of the contract. (Available on request)

vii. All Foskor procedures and policies applicable to the successful application of the contract. (Available on request)

13.2 Summarised requirements/extracts from Foskor COP's

13.2.1 Before entering and operating a service vehicle (Own vehicle) on the Foskor site, the appointed service provider shall:

- i. Ensure that his driver/s are in possession of a valid national driver's licence for the specific class of vehicle, has been tested by the Foskor mobile equipment training centre and authorised by a Foskor MHSA (Mines Health and Safety Act) regulation 2.13.1 appointee for the class of vehicle to be used on site.
(Contact the Foskor mobile equipment training centre on 015 789 2840 to make an appointment for competence testing and authorisations)
- ii. The appointed service provider shall, before entering and operating a vehicle or trailer on the Foskor premises:
 - a. Obtain permission from the Foskor Safety & Security manager to operate his nominated service vehicle/s or trailers on the Foskor site. (Forms will be provided)
 - b. Obtain a certificate of fitness from the Foskor Light Vehicle maintenance workshop supervisor or appointed Foskor inspector for his nominated service vehicle/s. Inspections conducted daily between 08:00 and 08:30 and between 13:30 and 14:00 (Excl Fridays) at the Light Vehicle Maintenance workshop.
 - c. Submit the above permission and COF in at the main security office for issue of a vehicle access disk.
- iii. Ensure that his service vehicles / trailers have been inspected (Daily) in accordance with the Foskor standard (COP 59) to ensure that they are safe and fit for use. (Forms will be provided) See Foskor COP 59, Trackless Mobile Machinery for details.

13.2.2 Before entering and working on the Foskor site the appointed service provider shall ensure that his workmen are:

- i. Briefed on the required task and have been informed of any abnormal conditions/situations.
- ii. Physically, emotionally, and mentally fit to perform their duty.
- iii. Issued with the necessary PPE (Personal Protective Equipment) to safely operate his service vehicles and perform the duty of maintaining, servicing, inspecting, and testing earthmoving- and mobile equipment.
- iv. Before commencement of work:
 - a. All tools and equipment shall have been inspected and tested to be in a good and safe working order.
 - b. All workmen have participated in the completion of a standard Foskor site risk assessment (Commonly known as a HIRA or Hazard Identification and Risk Assessment) and taken appropriate actions to mitigate any identified hazards.

13.2.3 Before entering and working on the Foskor site the appointed service provider shall ensure that his portable electrical equipment have been tested and declared safe to use by the Foskor electrical services workshop.

14. PERMIT TO WORK

Before any on-site work under this contract may commence, the appointed or successful service provider shall obtain from Foskor a PERMIT TO WORK. The following guidelines are provided in order to assist the appointed service provider in obtaining a PERMIT TO WORK. (See Foskor COP 28 Permit to work and COP 25 Control of Externally Provided Processes, Products and Services (Service provider Control) for details):

- i. The PERMIT TO WORK can be obtained from- and on completion returned to the Legal Administrator, Foskor Safety department.
- ii. Obtain a contract number from the Foskor procurement or projects department.

- iii. Appoint a subordinate manager in accordance with Regulation 2.6.1 and an on-site supervisor in accordance with Regulation 2.9.2 of the Mines Health and Safety Act.
- The appointed subordinate manager and -supervisor shall be required to write and pass the Foskor 2.6.1 and 2.9.2 legal examinations within 30 days after being awarded this contract.
- Attend an hour-long legal exam briefing any Thursday between 08:00 and 09:00 at the Security training hall.
- Write legal examination any Friday between 07:30 and 10:30 at the Security training hall.
- (Please book) iv. Appoint an on-site SHE-Rep in accordance with section 29(1) of the MHSA to assist the Regulation 2.6.1 and 2.9.2 in the daily on-site management of health, safety, and environmental issues.
- The designated SHE Rep must have the ability to read, write and express him/herself.
- The appointed SHE-Rep shall be required to attend a five day SHE-Rep training course within 30 days after being awarded this contract (Training free of charge). Make booking on 015 789 2531
- A pre-requisite for attending the SHE-Rep training course is successful completion of Basic Health & Safety Principals- and HIRA training.
- See Foskor's COP 5 Health and Safety Representatives for details.
- v. Provide a name list, including ID numbers, residential and postal addresses and telephone numbers of all of the appointed service providers on-site employees.
- vi. All of the appointed service providers on-site employees shall undergo a full medical examination at the Foskor onsite Clinix Clinic. The clinic can be contacted at 015 789 2427 for an appointment. Please note:
- All NEW- and employees LEAVING the service of the appointed service provider must undergo a full entry or exit medical examination
- Women who are pregnant or suspect that they may be pregnant must notify the examining medical practitioner.
- vii. The appointed service providers designated on-site drivers shall receive competence testing and authorisation to operate vehicles on the Foskor site
- viii. All of the appointed service providers' employees shall receive/have received training in:
- First aid level 1 (Provide own training)
 - Working at heights (Provide own training)
 - Basic Health & Safety Principals (Provide own training)
 - HIRA (Provide own training)
 - Basic fire fighting. (Provide own- or receive Foskor training, contact 015 789 2531 to book)
 - Lock out. (Provide own- or receive Foskor training, contact 015 789 2531 to book)
- All training not provided by Foskor must be verified by the Foskor training superintendent Mr. Johan Fouche. Please contact him on 015 7789 2525 to make an appointment or alternatively email proof of training and certificates to johanfo@foskor.co.za to confirm compliance before requesting his approval on the PERMIT TO WORK.
- ix. All of the appointed service providers' on-site employees shall receive the basic Foskor site induction training at the Foskor Security office.
- x. All of the appointed service providers' on-site employees shall receive site specific induction training provided by the Foskor area Regulation 2.6.1 appointee/s.
- xi. A BRA (Baseline Risk Assessment) shall be completed for ALL "typical" tasks that will be completed under this contract. The BRA to be approved by the responsible Foskor MHSA 2.13.1 appointee and signed by all of service providers employees. Make use of Foskor's own BRA document, Annexure 1.2, contained in COP 1, Risk and Opportunities Management (Available on request) xii. Attach a detailed SCOPE OF WORK describing the required task and -outcome of this contract.
- xiii. All Foskor's appointed MHSA Regulation 2.9.2, 2.6.1, 2.13.1 and 3.1.a managers must undersign/approve the PERMIT TO WORK.
- xiv. Registration and proof of payment under the Compensation for Occupational Injuries and Diseases Act, no. 130 of 1993. Registration number must be provided.
- xv. SARS issued tax clearance certificate. xvi. All relevant documentation and/or evidence of compliance must be attached to the PERMIT TO WORK.

xvii. Upon successful completion and approval of the PERMIT TO WORK the security department will issue the appointed service providers' employees with access ID cards. xviii. Any other documents, certificates or records as requested by a Foskor official deemed necessary to ensure that all safety, legislative and administrative requirements have been met must be attached to the PERMIT TO WORK.

xix. The appointed service provider must allow at least three to ten working days to complete all the PERMIT TO WORK requirements.

15. **SAFETY FILE**

The appointed contractor must compile a SAFETY FILE specifically for this contract. The SAFETY FILE must at all times be available for inspection by a Foskor official: The following guidelines are provided in order to assist the appointed contractor in compiling a SAFETY FILE:

Before any work may commence, the appointed service provider must, IN CONJUNCTION WITH THE FOSKOR SAFETY DEPARTMENT, compile a SAFETY FILE specifically for THIS contract. (Contact the area responsible safety representative, Ms Nnete Napo at 015 789 2547 / nneten@foskor.co.za or attend the monthly service providers meeting every 2nd Monday of the month (3rd Monday if 1st or 2nd Monday a public holiday) at 13:30 in the Foskor Plant Training hall)

The SAFETY FILE must at all times be available for inspection by a Foskor official.

SHE FILE INDEX / TABLE OF CONTENT - Typical

SHE FILE INDEX / TABLE OF CONTENT - Typical

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| 3. COP1: Foskor risk management 3 Clause 6.1.2.1 & 6.1.2.2: Hazard identification, risk assessment and determining controls. | |
| 4. COP88: Objectives, targets and management programmes 4 Clause 6.2.1: Planning to achieve OH&S objectives. Clause 6.2.2: Objectives and programs | |
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| 8. | COP 6: SHERQ Committees COP 7: Communication (Mini – business communications) Clause 7.4: Communication Clause 5.4 participation and consultation | 8 | |
| 9. | COP 42: Lighting: natural and artificial; COP 43: MCOP Occupational health programme on thermal stress COP 44: Sanitation plant hygiene amenities COP 45: MCOP occupational health program on personal Exposure to Air borne Pollutants COP 64: Ergonomics COP 86: MCOP for Occupation Health Program for noise Clause 8.1. Operational health program for noise Clause 8.1.1. General | 9 | |
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| 12. | COP 55: Stairs walkways handrails and Ladders Clause 8.1 Operational planning and control Clause 8.1.2 Eliminating hazards and reducing OH&S Risk | 12 | |
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| COP 102: MCOP: Risk based emergency care on mine | |
| COP 104: MCOP: Prevention of fires at mine | |
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| Clause 8.1.2 Eliminating hazards and reducing OH&S Risk | |
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| 27. COP 97: Erection and use of scaffolding | |
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| Clause 8.1 Operational planning and control | |
| Clause 8.1.2 Eliminating hazards and reducing OH&S Risk | |
| 28. COP 98: Water safety | 28 |
| Clause 8.1 Operational planning and control | |
| Clause 8.1.2 Eliminating hazards and reducing OH&S Risk | |
| 29. COP 101: MCOP: The right to refuse dangerous work and withdraw from | |
| 29 dangerous workplace. | |
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33. COP 82: Mandatory Code of Practice for Mine Residue Deposits.
 33 Clause
 8.1 Operational planning and control
 Clause 8.2 Emergency preparedness and response
34. COP91: Combat rock fall and slope instability accidents in surface mines.
 34 Clause 8.1 Operational planning and control
 Clause 8.2 Emergency preparedness and response

NOTE:

- 1) If a COP is not applicable to your section, please complete and attach the “Not Applicable” form in the space of the COP.
- 2) Always keep your file neat and clean
- 3) If a COP is not applicable to this contract/project, please complete and attach the “Not applicable” form in the space of the COP

TYPICAL CONTENTS OF SAFETY FILE:

- i. Title and index cover page
- ii. A copy of the PERMIT TO WORK. iii. A copy of the MSHA Regulation 2.6.1 and -2.9.2 and SHE Rep appointment letters. iv. A copy of Foskor COP 25, Service provider control.
- v. A copy of LME (Lifting Machine Entity) registration certificate with the Department of Labour.
- vi. Copy of LMI (Lifting Machine Inspector) registration certificate with the Engineering Council of South Africa in the employ of the service provider.
- vii. Base line risk assessment of ALL and ANY POTENTIAL tasks that may be performed on site under this contract. See Foskor COP 26, Critical Task Descriptions for details. viii. Copies of critical task descriptions and standard operating/maintenance procedures.
- ix. Copies of the appointed service providers safety, health, environmental, HIV and AIDS, smoking and waste management policies.
- x. Training records of all on-site employees.
- xi. Employee records of actual time worked (Normal and overtime). xii. Copy of on-site induction training.
- xiii. Records of inspections of TMM (Trackless Mobile Machinery) and trailers. See Foskor COP 59, Trackless Mobile Machinery for details. xiv. Records of issues and inspections of PPE (Personal Protective Equipment) and safety equipment. See Foskor COP 65, Personal Protection Equipment for details.
- xv. Records of issues and inspections of PEE (Portable Electrical Equipment). See Foskor COP 60, Portable electrical Equipment for details. xvi. Records of issues and inspections of tools and equipment. See Foskor COP 63, hand tools for details
- xvii. Records of daily, weekly and monthly 2.6.1 / SHE Rep safety inspections. See Foskor COP 22, SHE Inspections for details.
- xviii. Records of daily green-area and safety talks. See Foskor COP 7, Communication for details.
- xix. Any other documents, certificates or records as requested by a Foskor official deemed necessary to ensure that all safety, legislative and administrative requirements have been met.

Note: The bidder / Service provider can obtain an updated CD/Disk with all Foskor COP's from the Projects Department on 015 789 2249 or viveks@foskor.co.za.

FOSKOR LIFE SAVING RULES

1. Risk assessments and clearance certificates
2. Lifting operations
3. Working at Heights
4. Confined space entry
5. Positive energy isolation and Lock-out
6. Moving Machinery
7. Personal protective equipment

Risk assessment is also on life saving rules and it this is applicable to all the jobs and trainings apply to all that will do physical work on Foskor site !

15.1 Add any additional safety requirements

- **None**

16. PARAMETERS

16.1 Design parameters

All plant and equipment will be designed to:

- Operate satisfactorily under atmospheric, ambient, and other conditions present at the site location
- Ensure interchangeability of units and/or sub parts throughout the plant to reduce spares holding requirements – take old plant equipment into account
- Ensure reliability and maintainability. A minimum availability of 98% is required
- Operate without undue vibration, stresses (temperature and built in) and excessive noise
- Comply with legal requirements in terms of the water license and DWA

16.2 Specifications, Codes, Standards and Regulations

The Latest edition of the South African National Standards in effects at the date of projects design shall establish the minimum requirements for design, materials, and construction. This should be referenced with the Foskor General Engineering specifications and requirements of the Foskor SHERQ system (COP's). No work shall be contemplated which is in breach of any legislation in South Africa – Typically:

- Water license - 04/B72K/ACGIJ/962 Requirements
- Occupational Health and Safety Act (Act 85 of 1993)
- Mine Health and Safety Acts and regulations (Act 29 of 1996)
- Explosive Acts and Regulations - South Africa
- DWS and the National Water Act.
- Foskor COP's and applicable General SHEQ Requirements
- Foskor Engineering Specifications
- Chamber of Mines / Mine Council SHEQ Requirements (Milestones)
- Atmospheric Emissions Licence - 13/2/AEL-02 Requirements
- The latest revisions of the SANS standardized specifications and Foskor Specifications as applicable at the time of quotation shall apply to this contract.

Note! The equipment to be capable of continuous operation 24 hrs/day, 365 days/year with operating availability equal to 100%.

16.3 Site Geography

The plant is located at Phalaborwa, Limpopo, South Africa

16.4 Ambient conditions

- Ambient temperature

| | | |
|--------|-----------------------|----------------|
| Summer | 35 Degrees Avg. 17 | 50 Degrees Max |
| Winter | Degrees Avg. | 2 Degrees Min |

- Site Altitude: 380m
- Prevailing wind direction: Generally South Easterly - Maximum design velocity 40m/s (144km/h)

- Very dusty conditions
- Average annual rainfall = 540 mm

16.5 Foskor General Engineering Specifications (should be consulted prior to finalization of any design or specification)

| Name | Modified | Modified By |
|---|----------------|-----------------|
| Engineering Specification Index | 15 April, 2016 | Khayelihle Pepu |
| GS001 - General Design Information - Rev 1 | 15 April, 2016 | Khayelihle Pepu |
| GS002 - Engineering Drawings - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS003 - Quality Control Procedures - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS005 - Concrete and Formwork - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS007 - Plate work - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS008 - Welding procedures - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS009 - Structural fabrication and erection - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS011- Piping - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS012 - Pressure vessels - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS013M - Painting and Protective Coatings | 15 April, 2016 | Khayelihle Pepu |
| GS014 - Rubberlining - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS015 - Fencing - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS016 - Roofing and side cladding - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS017 - Fuel - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS018 - Lubrication - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS019 - Liquid containemt bund walls - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS020 - General purpose valves - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS021 - Gearboxes - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GS022 - Chainblocks and lever hoists - Rev 0 | 15 April, 2016 | Khayelihle Pepu |
| GSI-004 - Field Instrumentation Standards | 15 April, 2016 | Khayelihle Pepu |

Service provider /Contrator /Supplier - Please ensure that you have the latest copy of Specifications before any activity is committed.

| <u>SPECIFICATION NUMBER</u> | <u>REVISION</u> | <u>TITLE</u> |
|-----------------------------|-----------------|---|
| EE-1 | Latest Revision | Motor Control Centre & Switchgear |
| EE-2 | Latest Revision | Squirrel Cage Induction & Wound Rotor Motors |
| EE-11 | Latest Revision | Power Factor Correction Equipment |
| GE-1 | Latest Revision | Design Criteria for Electrical Installations |
| GA-1 | Latest Revision | Procedures for Enquiries & Tenders |
| GD-1 | Latest Revision | General Requirements for Design, Project Management & Tenders |
| GD-2 | Latest Revision | Engineering Change Order (E.C.O) Procedure |
| GM-1 | Latest Revision | Mechanical Equipment |
| GM-5 | Latest Revision | Pipe Standards |
| GM-6 | Latest Revision | Engineering Drawing & Document Requirements |
| GM-8 | Latest Revision | Surface Protection |
| GM-3 | Latest Revision | Painting & Surface Protection of Steel |
| GS-1 | Latest Revision | Structural Steel work & Plate work Fabrication & Erection |
| | | |
| GQ-1 | Latest Revision | Quality Control |
| GSI-1 | Latest Revision | General specifications & Procedures |
| GSI-2 | Latest Revision | Installation & Commissioning |
| GSI-3 | Latest Revision | General Equipment Specification |
| GSI-4 | Latest Revision | Field Instrumentation Specification |
| | | |

17. PROJECT MANAGEMENT - CONTRACTOR

- a) Nominate a single window of communication to Foskor – Typically the appointed contractor 2.6.1
- b) Attend meetings as agreed during the project kick off meeting
- c) Submit Progress reports (Format & interval) as defined in the Kick off Meeting (Invoicing, Labour, Performance against plan, Contractor purchases, Quality Management, Safety, Etc.
- d) Manage and participate in the “Daily Journal” as part of executing the project
- e) All meetings will be held at FOSKOR offices, unless otherwise stated
- f) The contractor to provide updated project management plans on progress as defined by the Foskor Project Engineer.

- g) If the project is executed based on a shutdown approach the contractor will produce a formal Works Breakdown Structure of the works.
- h) If the contractor cannot produce a proper WBS then the contractor will be required to subcontract this function to produce the WBS and manage the WBS for the duration of the project. This cost must be included in the contractor's price
- i) **WBS - WBS** is a hierarchical and incremental decomposition of the project into phases, deliverables, and work packages. It is a tree structure, which shows a subdivision of effort required to achieve an objective, for example a program, project, and contract.
- j) This includes arrangements, tools, equipment, labour, Tasks, Purchase, Quality, Communication, etc
- k) Project progress updates - If the contractor cannot produce proper updates on a WBS then the contractor will be required to subcontract this function to produce the WBS updates for the duration of the project. This cost must be included in the contractor's price

The Service provider is responsible for managing the project and this is graphically displayed below indicating where what functions lies. Graphical presentation only covers some basic aspects.

18. LIAISON AND CO-OPERATION WITH OTHERS

- The CONTRACTOR/ SERVICE PROVIDER shall be required to co-operate and liaise with Foskor appointed project manager
- The CONTRACTOR/ SERVICE PROVIDER must note that construction is within an operational plant.
- The CONTRACTOR/ SERVICE PROVIDER may appoint a Foskor approved sub-contractor
- The CONTRACTOR/ SERVICE PROVIDER shall be required to work in conjunction with the Foskor appointed structural-, electrical-, equipment- and instrumentation installation contractor – if applicable.

19. GENERAL CONDITIONS – COMMERCIAL

19.1 Extensions, penalties, and retentions

- a) Extension on the promised completion or Milestone date may be requested but needs to be approved by Foskor. The contractor should be in possession of a formal document issued via Foskor Procurement indicating that this request was approved
- b) Any additional works not defined in the order needs to be approved by Foskor in writing before any work can commence.

| Description | Condition | Duration |
|------------------|-----------------------------|---|
| Penalties | 2% per week, maximum of 10% | Late Delivery after promised completion date |
| Performance Bond | 10% of Contract Value | 100% release after 12 months of practical completion. |

| | | |
|-----------------------|--|---|
| Retention | 10 % of Contract value | 50% release on achievement of maximum contract value (including all variation orders), remaining 50% release after defects liability period of 18 months. |
| Type Of Contract | FIDIC | |
| Tender price validity | 120 days | |
| Escalation | First 12 months Fixed, FIDIC formu thereafter, if applicable | Contract Duration |

All delays must be immediately brought under the attention of the section engineer and the responsible party agreed upon immediately.

19.2 After sales service or requirements

After sales service requirements are listed below:

- a) Full description of guarantee and guarantee period to be attached to the official tender
- b) Full description of planned support during AND after the guarantee period to be attached to the official tender. (The supplier must take note that he will be required to undergo specific inductions, training and obtain authorisations before being allowed to enter and work on the Foskor site – details can be forwarded on request)

19.3 Invoice due dates

The due dates for certificate and invoices are 15th of every month. Late submission will only be processed the next month.

20. TENDER EVALUATION CRITERIA

- a) As part of the process to assist with the evaluation of the bidders proposal/quotation and to make an informed decision in the awarding of this tender, the following information is required
- b) The following tender evaluation criteria will be used for adjudicating the Contractor submitted tender.
- c) Please provide the required documentation as requested in the “Proof / documents to be submitted” column. Please be specific when submitting documents by ensuring it answer the item specified.
- d) Please use the annexure number as indicated to identify proof submitted.
- e) Failure to submit the relevant documentation as requested in the Evaluation criteria document may lead to a disregard of the submitted tender.

PRE-QUALIFICATIONS - REQUIREMENTS

Bid submission not meeting the mandatory requirement will result in the bid being disqualified. Ensure that the documentation supporting the Pre-Qualifications requirements are annexed immediately after the cover letter.

| No | Mandatory Requirement | Comments |
|----|--|---|
| 1 | CIDB Rating - The Main Contractor should have a minimum of CIDB 7CE or | Supply valid cidb certificates Mark it a |

| | | |
|---|--|---|
| | CIDB 7SL | Annexure 4B. |
| 2 | The main bidder should have Previous Proven experience of successfully executing Concrete works (Exceeding 100 m3) and Structural (exceeding 100 tons) Refurbishment / Repair work inside a continuously operating production plant in mining environment. | Give reference list of similar jobs during last 10 years, with values and contact numbers for verification. Mark it as Annexure 1A. |

T093/23 E & F Flotation Bank Structural (Steel & Concrete) Refurbishment Project

| Evaluation Criteria (Technical) | | | | |
|--|--|----------------|---|-------|
| E & F Flotation Bank Structural (Steel & Concrete) Refurbishment Project | | | | |
| No | Technical Criteria Description | % Contribution | Proof / documents to be submitted | Notes |
| 1 | Experience & Team competence | | | |
| a) | The main bidder should have Previous Proven experience of successfully executing Concrete works (Exceeding 100 m3) and Structural (exceeding 100 tons) Refurbishment / Repair work inside a continuously operating production plant in mining environment. Scoring: Previous Proven exp = 0%; References previous exp = 1 for two or more references | 20% | Give reference list of at least 1 similar job during last 10 years, with values and contact numbers for verification <i>(Mark it as Annexure 1A)</i> | |
| b) | Team - Capability to provide qualified Foreman, Riggers, Concrete Foreman, Coded Welders, Corrosion Protection team etc. Scoring: No Comply = 0 %, Comply 100 % | 5% | Give reference list and project names with CV's <i>(Mark it as Annexure 1B)</i> | |
| 2 | Regulatory/ Legal / Licences / Registrations (where applicable) | | | |
| a) | NA | 0% | | |
| 3 | Company Capacity – <u>Weight not to be less than 25%</u> | | | |

| a) | Company - Execute construction according to a pre-approved WBS / Project Schedule Scoring: No Comply = 0 %; Partial Comply = 50%. Full Comply = 100 % | 10% | Provide signed off WBS/ Project Schedules of at least two (2) previous projects of similar nature. <i>(Mark it as Annexure 3A)</i> | |
|--|--|----------------|--|--|
| b) | Quality Planning, Quality assurance/control plan, Quality Control Scoring: No Comply = 0 %; Partial Comply = 50%. Full Comply = 100 % | | 10% | Provide signed off Quality Management Plan of at least two (2) previous projects of similar nature. <i>(Mark it as Annexure 3B)</i> |
| c) | Contractor Site Equipment List (Project Specific) Scoring: No equipment = 0 %; Partial Equipment = 50 %; All Relevant Equipment = 100 % | 10% | Focus is LDV, Truck, Lifting tackle, Concrete Mixers, Welding Machines, Shutters, Flame cutting, Hand tools, Mobile Crane, Corrosion Protection capability etc. <i>(Mark it as Annexure 3C)</i> | |
| Evaluation Criteria (Technical) | | | | |
| E & F Flotation Bank Structural (Steel & Concrete) Refurbishment Project | | | | |
| No | Technical Criteria Description | % Contribution | Proof / documents to be submitted | Notes |
| d) | Contractor Steel Workshop Capabilities (Project Specific) Scoring: No equipment = 0 %; Partial Equipment = 50 %; All Relevant Equipment = 100 % | 10% | Focus is Overhead Crane, Steel Plate Cutter, CO2 Welding, Corrosion Protection capability, etc. <i>(Mark it as Annexure 3D)</i> | |
| e) | Project team Organogram indicating names, positions, trades for this project Scoring: No Organogram = 0 %; Organogram with some skills = 50 %; Organogram with all relevant skills = 100 % | 5% | Submit organogram with names, position, and skills. <i>(Mark it as Annexure 3E)</i> | |
| 4 Accreditation | | | | |
| a) | ISO Certification Scoring: No Comply = 0 %, Comply 100 % | 10% | Submit Valid ISO Certificate <i>(Mark it as Annexure 4A)</i> | |

| | | | |
|---|---|-------------|---|
| b) | Main Contractor - CIDB Rating of 7CE or 7SL Scoring: Pre- Qualification No Comply = 0 %, Comply 100 % | 20 % | Submit Valid cidb certificate (Mark it as Annexure 4B) |
| | | | |
| Total Technical Score | | 100% | |
| Note: In order to qualify for the second evaluation phase (commercial) your company needs to score a minimum of 70% on the technical evaluation. | | | |

Foskor reserves the right to conduct vendor audits to verify the references and credentials, including visits to applicable vendor sites and projects.

21. PRICING SCHEDULE

Tender No.: T093/23

Description: E & F Flotation Bank Structural (Steel & Concrete) Refurbishment Project

1. Measurement and payment clauses of the COLTO (1998) Standardised Specifications, as well as the Particular Specifications, shall be deemed to form part of and included in the pricing instructions.
2. The units of measurement described in the Bill of Quantities are metric units. Abbreviations used in the Bill of Quantities are as follows:

% = percent m².pass = square metre-pass
h = hour m³ = cubic metre
ha = hectare m³.km = cubic metre-kilometre kg = kilogram MN = meganewton
kl = kilolitre MN.m = meganewton-metre km = kilometre
MPa = megapascal km-pass = kilometre-pass No. = number
kPa = kilopascal Prov sum = Provisional
sum kW = kilowatt P C sum = Prime Cost sum
ℓ = litre sum = lump sum m = metre t = ton (1 000 kg) mm = millimetre W/day = Work day
m² = square metre

3. Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.
4. The prices and rates to be inserted in the Bill of Quantities are to be the full inclusive prices for the work described under the items. Such prices and rates shall cover all costs and expenses that may be required in accordance with the provisions of the Scope of Work, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the Contract Data, as well as overhead charges and profit. These prices shall be used as a basis for assessment of payment for additional work that may have to be carried out.
5. It will be assumed that price is included in the Bill of Quantities are based on Acts, Ordinances, Regulations, By-laws, International Standards and National Standards that were published 28 days before the closing date for tenders. (Refer to www.sabs.co.za or www.iso.org for information on standards).
6. Where the Scope of Work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amount tendered for such items.
7. An item against which no price is entered will be considered to be covered by the other price s or rates in the Bill of Quantities. A single lump sum will apply should a number of items be grouped together for pricing purposes.
8. The quantities set out in the Bill of Quantities are approximate and do not necessarily represent the actual amount of work to be done. The quantities of work accepted and certified for payment will be used for determining payments due and not the quantities given in the Bills of Quantities.
9. Reasonable compensation will be received where no pay item appears in respect of work required in the Bills of Quantities in terms of the Contract and which is not covered in any other pay item.
10. The short descriptions of the items of payment given in the Bill of Quantities are only for the purposes of identifying the items. More details regarding the extent of the work entailed under each item appear in the Scope of Work.
11. The Bill of Quantities has been drawn up in accordance with the latest issue of the COLTO (1998) Standardised Specifications. Descriptions in the Bill of Quantities are abbreviated and must be read in conjunction with the measurement and payment clauses of the applicable specifications.

SCHEDULE OF QUANTITIES

| NUMBER | ITEM DESCRIPTION | UNIT | QUANTITY | RATE | AMOUNT R |
|--------|--|------|----------|------|----------|
| 1200 | GENERAL REQUIREMENTS AND PROVISIONS | | | | |
| B12.01 | Supply and erection of contract sign boards | No | 3 | | |
| 1300 | CONTRACTOR'S ESTABLISHMENT ON SITE AND GENERAL OBLIGATIONS | | | | |

| | | | | | |
|--------|--|-------|------|--|--|
| 13.01 | Contractor's general obligations: | | | | |
| (a) | Fixed obligations | L/sum | 1 | | |
| (b) | Value-related obligations | L/sum | 1 | | |
| (c) | Time-related obligations | Sum | 1 | | |
| (d) | Occupational Health and Safety | Sum | 1 | | |
| B13.03 | Screening and Protection | | | | |
| (a) | Dust mitigation around Pump Floor Laboratory and all construction work areas | L/sum | 1 | | |
| (b) | Dust mitigation to adjacent tanks | L/sum | 1 | | |
| (c) | Miscellaneous make-safe measures below flotation floor | L/sum | 1 | | |
| (d) | Miscellaneous make-safe measures above flotation floor | L/sum | 1 | | |
| 6100 | FOUNDATIONS FOR STRUCTURES | | | | |
| 61.13 | Dowel bars | | | | |
| (a) | Y16 dowels of length 1.7m drilled and epoxied 200mm into floors with Sika Anchorfix (or equivalent approved) | kg | 4200 | | |
| 6200 | FALSEWORK, FORMWORK AND CONCRETE FINISH | | | | |
| 62.02 | Vertical formwork to provide: | | | | |
| (a) | Class F3 surface finish to: | | | | |
| (i) | Columns | m2 | 525 | | |
| (ii) | Provisional for repair | m2 | 105 | | |
| 62.03 | Horizontal formwork to provide: | | | | |

| | | | | | |
|-------|--|----|-----|--|--|
| (a) | Class F3 surface finish to: | | | | |
| (i) | Provisional for repair | m2 | 150 | | |
| 62.04 | Inclined formwork to provide: | | | | |
| (a) | Class F3 surface finish to: | | | | |
| (i) | Provision for repair | m2 | 150 | | |
| 6300 | STEEL REINFORCEMENT FOR STRUCTURES | | | | |
| 63.01 | Steel reinforcement for: | | | | |
| (a) | Columns: | | | | |
| (ii) | High-yield stress steel bars (hot-rolled, deformed) | t | 2.1 | | |
| (b) | Provisional for repair: | | | | |
| (ii) | High-yield stress steel bars (hot-rolled, deformed) | t | 5.3 | | |
| 6400 | CONCRETE FOR STRUCTURES | | | | |
| 64.01 | Cast in situ concrete: | | | | |
| (a) | Class W30/19 (W/C:0.45, 25% flyash) in | | | | |
| (i) | Column thickenings | m3 | 150 | | |
| (ii) | Provisional for repair | m3 | 200 | | |
| 64.04 | Epoxy bonding of new concrete surfaces to old | | | | |
| (a) | SikaLatex as a bonding agent for repair (or equivalent approved) | m2 | 105 | | |
| 6700 | STRUCTURAL STEELWORK | | | | |

| | | | | | |
|-------|---|----|------|--|--|
| 67.01 | Structural steel, Grade S355JR: | | | | |
| (a) | Structural steel measured per ton mass | | | | |
| (i) | Column strengthening and fixing: 100x100x10 EA (GL X4- M14) | t | 25 | | |
| (ii) | Column strengthening and fixing: 80x8 Flat bar (GL X4- M14) | t | 15 | | |
| (iii) | Primary Flotation Floor Beams and fixings: 610x229x101 I-Beam (Row 2-11) | t | 65 | | |
| (iv) | Secondary Flotation Floor Beams and fixings: 254x146x31 I-Beam (Row 2-15) | t | 85 | | |
| (v) | Cell Tank Support Columns and fixings: 203x203x46 H-section (Row 4-11) | t | 10 | | |
| (v) | Cell Tank Support Beams and fixings: 457x191x67 I-Beam (Row 2-11) | t | 55 | | |
| 67.02 | Anchor Bolts: | | | | |
| (b) | Description by number | | | | |
| (i) | M16 galvanised anchor bolts Grade 8.8, 125mm long | No | 5158 | | |
| (ii) | M20 galvanised anchor bolts Grade 8.8, 170mm long | No | 1898 | | |
| (iii) | M24 galvanised anchor bolts Grade 8.8, 210mm | No | 832 | | |

| | | | | | |
|---------|---|----------|------|-----------|-----------|
| | long | | | | |
| 8100 | TESTING MATERIALS AND WORKMANSHIP | | | | |
| 81.02 | Other special tests requested by the Engineer | Prov Sum | 1 | 100 000 | 100 000 |
| 8400 | PAINTING | | | | |
| 84.01 | Painting: | | | | |
| (d) | All new and refurbished steel work. Apply two 250-micron coats of PHENOLINE 921 by CARBOLINE to specification. (or equivalent approved) | ton | 250 | | |
| 84.02 | Protective coating for concrete surfaces. | | | | |
| (a) | Apply ABE QuickSpray Supreme HP coating (VIP Coating Solutions), or equivalent approved, on top of flotation floor. | m2 | 3000 | | |
| F12100 | REHABILITATION OF STRUCTURES | | | | |
| F121.01 | Allowance for miscellaneous repair items not covered in the following | Prov Sum | 1 | 1 000 000 | 1 000 000 |
| F12100 | ACCESS FOR REHABILITATION | | | | |

| | | | | | |
|---------|--|-------|-----|--|--|
| F121.01 | Temporary access structures and working platforms | | | | |
| (a) | Access and platforms to 0-5m | | | | |
| (i) | Design, supply and erect inside the structure and height ranges inclusive of dismantling and re-assembling as required | L/sum | 1 | | |
| (ii) | Dismantle and remove from location or structure | L/sum | 1 | | |
| (b) | Access and platforms to 5-10m | | | | |
| (i) | Design, supply and erect inside the structure and height ranges inclusive of dismantling and re-assembling as required | L/sum | 1 | | |
| (ii) | Dismantle and remove from location or structure | L/sum | 1 | | |
| F121.03 | Access at end of maintenance period | | | | |
| (a) | Access to locations | L/sum | 1 | | |
| F12200 | DEMOLITION AND REMOVAL OF STRUCTURAL CONCRETE | | | | |
| F122.01 | Demolition of concrete members | | | | |
| (b) | Partial demolition (including discarding) | | | | |
| (i) | Provisional for repair | m3 | 120 | | |
| F12300 | SURFACE AND STRUCTURAL REPAIR OF CONCRETE MEMBERS | | | | |

| | | | | | |
|---------|--|-------|---------|--|--|
| F123.01 | Cementitious repair mortar | | | | |
| (a) | Provision for larger concrete repair Between Row 11-15 | litre | 25 0 10 | | |
| (b) | Provision for larger concrete repair Between Row 2-11 | litre | 25 0 10 | | |
| (c) | Tower block minor repair | litre | 20 000 | | |
| F123.03 | Proprietary cementitious repair compound (PRO-STRUCT 528VO-MCI refer to sheet 011), or equivalent approved | | | | |
| (a) | Columns | litre | 400 | | |
| (b) | Provision for smaller concrete repair Between Row 11-15 | litre | 600 | | |
| (c) | Provision for smaller concrete repair Between Row 2-11 | litre | 600 | | |
| F123.04 | Curing of repair surfaces | | | | |
| (a) | Coating by curing compound | | | | |
| (i) | Provisional for repair | m2 | 200 | | |
| F12400 | GROUTING AND CRACK INJECTION | | | | |
| F124.02 | Grouting for: | | | | |
| (a) | Below columns (SikaGrout 212), or equivalent approved | litre | 841 | | |
| (b) | Beam soffits (SikaGrout 212), or equivalent approved | litre | 707 | | |
| F124.03 | Grouting of dowel bars and anchors into: | | | | |
| (a) | Holes cored into concrete section | | | | |

| | | | | | |
|---------|---|-------|------|--|--|
| (i) | Holes (20mm dia, 200mm deep) in floor | No | 1550 | | |
| (ii) | Holes (20mm dia, 120mm deep) in flotation floor, beams for column fixing and cell beams | No | 5132 | | |
| (iii) | Holes (28mm dia, 200mm deep) in beams, column and walls | No | 1851 | | |
| (iv) | Holes (28mm dia, 350mm deep) in columns | No | 68 | | |
| (v) | Holes (28mm dia, 450mm deep) in columns | No | 236 | | |
| F12600 | PROTECTIVE COATINGS AND TREATMENTS FOR CONCRETE | | | | |
| F126.01 | Cleaning and preparation of concrete surface | | | | |
| (a) | Water jetting existing concrete to remove loose material for refurbishment. | m2 | 5000 | | |
| F12700 | EXTERNAL BONDING OF STEEL PLATES | | | | |
| F127.03 | Adhesive required | | | | |
| (a) | Epoxy equal angles to columns (PRO-STRUCT 617NS), or equivalent approved | litre | 525 | | |
| (b) | Epoxy Brackets to columns (Sikadur 31), or equivalent approved | litre | 210 | | |
| F127.06 | Protective paint coatings | | | | |
| (a) | Reinforcement primer (Nitoprime Zincrich, or equivalent approved) to manufacturer's specification | litre | 250 | | |
| F129.01 | Concrete cover survey/rebar locator at column bolting positions | LS | 1 | | |
| F121100 | REPAIR OF CORRODED STEEL ITEMS | | | | |

| | | | | | |
|---------------|---|-----------|----------|---------|---------|
| F1213.01 | Refurbishment of damaged steel elements | | | | |
| (a) | Walkway refurbishment | Prov Sum | 1 | 750 000 | 750 000 |
| B1213.02 | Remove existing structural steelwork | | | | |
| (a) | Angles on corners of columns | t | 18 | | |
| 12X.01 | Temporary Support | | | | |
| a) | Design, construct and erect temporary supports as per sheet 5 | | | | |
| l) | Propping as per drawings | LS | 1 | | |
| B10.01 | Mechanical works | | | | |
| (a) | Design and relocation of Electrical Services: Pump Floor | PC Sum | 1 | 300 000 | 300 000 |
| (b) | Design and relocation of Electrical Services: Flotation Floor | PC Sum | 1 | 300 000 | 300 000 |
| (c) | Contractor's handling cost and profit in respect of item B10.01(a-b) | % | | | |
| B10.02 | Electrical works | | | | |
| (a) | Design and relocation of Mechanical Services: Pump Floor | PC Sum | 1 | 300 000 | 300 000 |
| (b) | Design and relocation of Mechanical Services: Flotation Floor | PC Sum | 1 | 300 000 | 300 000 |
| (c) | Contractor's handling cost and profit in respect of item B10.02(a-b) | % | | | |
| B2000 | DAYWORKS | | | | |
| | All dayworks incidental to works comprising this contract shall be ordered by the Engineer in writing and payment for such work shall be made on the following basis: | | | | |
| B20.01 | LABOUR | | | | |

| | | | | | |
|--------|---|----|-----|--|-----------|
| | The rates entered against each item shall provide for the actual wages paid to employees and shall include all allowances and benefits, the cost of supervision, use of small tools etc | | | | |
| (a) | Foreman | hr | 20 | | Rate Only |
| (b) | Artisan | hr | 30 | | Rate Only |
| (c) | Shutterhand | hr | 20 | | Rate Only |
| (d) | Labourer | hr | 100 | | Rate Only |
| (e) | During Sundays and Public Holidays | | | | |
| (f) | Foreman | hr | 20 | | Rate Only |
| (g) | Artisan | hr | 30 | | Rate Only |
| (h) | Shutterhand | hr | 20 | | Rate Only |
| (i) | Labourer | hr | 100 | | Rate Only |
| B20.02 | PLANT | | | | |
| | The rates entered against each item shall provide for hire rents, operators costs as well as all costs of running equipment. | | | | |
| (a) | Tipping truck - capacity 10 m ³ | hr | 80 | | Rate Only |
| (b) | Mobile air compressor capacity 10m ³ /min | hr | 50 | | Rate Only |
| (c) | Mobile air compressor capacity 25m ³ /min | hr | 50 | | Rate Only |
| (d) | Front end Loader Cat 903 | hr | 50 | | Rate Only |
| (e) | Front end Loader Cat 966 | hr | 50 | | Rate Only |
| (f) | Pickup van 680kg | hr | 20 | | Rate Only |
| (g) | Paving breaker. Air driven including hosing | hr | 100 | | Rate Only |
| (h) | Scabbling equipment. Air driven including hosing | hr | 100 | | Rate Only |

| | | | | | |
|-----|------------------------------|----|----|--|-----------|
| (i) | Concrete vibrating equipment | hr | 20 | | Rate Only |
| | | | | | |

SCHEDULE SUMMARY:

| Description | Amount R |
|--|------------|
| SECTION 1200: GENERAL REQUIREMENTS AND PROVISIONS | |
| SECTION 1300: CONTRACTOR'S ESTABLISHMENT ON SITE AND GENERAL OBLIGATIONS | |
| SECTION 6100: FOUNDATIONS FOR STRUCTURES | |
| SECTION 6200: FALSEWORK, FORMWORK AND CONCRETE FINISH | |
| SECTION 6300: STEEL REINFORCEMENT FOR STRUCTURES | |
| SECTION 6400: CONCRETE FOR STRUCTURES | |
| SECTION 6700: STRUCTURAL STEELWORK | |
| SECTION 8100: TESTING MATERIALS AND WORKMANSHIP | |
| SECTION 8400: PAINTING | |
| SECTION F12000: REHABILITATION OF STRUCTURES | |
| SECTION F12100: ACCESS FOR REHABILITATION | |
| SECTION F12200: DEMOLITION AND REMOVAL OF STRUCTURAL CONCRETE | |
| SECTION F12300: SURFACE AND STRUCTURAL REPAIR OF CONCRETE MEMBERS | |
| SECTION F12400: GROUTING AND CRACK INJECTION | |
| SECTION F12600: PROTECTIVE COATINGS AND TREATMENTS FOR CONCRETE | |
| SECTION F12700: EXTERNAL BONDING OF STEEL PLATES | |
| SECTION F121100: REPAIR OF CORRODED STEEL ITEMS | |
| SECTION B1000: MECHANICAL AND ELECTRICAL WORKS | Rates only |
| SECTION B2000: DAYWORKS | |
| TOTAL excl. VAT | |
| VAT @ 15% | |
| TOTAL incl. VAT | |

All price alterations must be signed for by the bidder confirming that such changes were made by the bidder. **PLEASE NOTE THAT PRICE CHANGES WITHOUT A SIGNATURE WILL LEAD TO THE DISQUALIFICATION OF THE BID SUBMITTED.**

NOTE: The onus lies with the tenderer to make sure that all formulas and calculations are correct. Calculation errors discovered during the evaluation process will be logged as a non-conformance and the tender / quotation will therefore be disregarded

22. ACCEPTANCE

The conditions and requirements as stated in this “Scope of Work” are accepted with the following **exceptions / exclusions**: -

The conditions and requirements as stated in this “Scope of Work” are accepted with the following **inclusions**: -

Sub-contractor (Please provide list and function)

Failure to complete this form will lead to disqualification – Please do not leave blanks!

BBBEE Level Black Ownership % Black Woman Ownership %

Tender Validity Days Manufacturing Period Days Installation Period Days

Guarantee Commencement after receipt of official purchase order

Payment terms

Price Basis for the duration of the contract / till supply of goods (Please tick):

Duration of fixed price 24 Months

Fixed

Price Base Date Variable

If variable provide price variation factors, percentages and formula in cover letter. (Please specify indices to be used)

Price variation factors & percentages (e.g. material, labour, fuel, overheads, admin etc)

| Factor | % |
|--------|---|--------|---|--------|---|--------|---|--------|---|
| | | | | | | | | | |

Where prices include a foreign currency rate please provide:

% of price subject R O E % ROE = ZAR

ROE Base Date

Note: If the above fields are not completed, it is confirmed that the quoted price/s are valid for the entire contract period mentioned and no escalation in the price is allowed under any circumstances.

I, _____ in my capacity as _____ for and on behalf of _____ hereby acknowledge that I have read and understand the Instruction to Tender and the Scope of Work as detailed in this document and accept all the Terms and Conditions of Tender T -22.

Signed at _____ on this the _____ day of _____ 2023 Signature: _____

Witnesses:

1. _____ Name: _____
2. _____ Name: _____

Name: _____

Signature: _____

Designation: _____

Date: _____

Note: It is imperative to complete this schedule in full where applicable, marked “N/A” where not applicable and signed off in full, **unsigned bids will not be accepted**. All the supporting documentation requested with the tender document, scope of work and evaluation criteria need to be submitted with the tender. Tenders received without supporting documentation requested for the tender evaluation **will not be considered**.

23. **DOCUMENTED INFORMATION**

| DESCRIPTION | RESP | LOCATION | FILE NAME / INDEX | RETENTION TIME (MINIMUM) |
|----------------|-------------|-------------|-------------------|--|
| Scope of Works | Procurement | Procurement | Procurement | As per Procurement Policies and procedures |
| | | | | |
| | | | | |

24. **REFERENCES**

- Code of Practice Foskor Risk Assessment (COP 01).
- Quality Management Systems – Requirements (ISO 9001:2015).
- Environmental Management Systems – Requirements with guidance for use (ISO 14001:2015).
- Occupational Health and Safety Management Systems – Requirements with guidance for use (ISO 45001:2018).
- DEKRA SHIELD Systems

25. **ANNEXURES**

ANNEXURE A: SPECIFICATION

PART B: MATTERS RELATING TO THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE WORKS

B1. STANDARD SPECIFICATIONS

The Standard General and Technical Specifications for Roadworks shall be the COTO - Standard Specifications for Road and Bridge Works for State Road Authorities (1998). Formerly known as COLTO.

The Standard Specifications forming part of this contract have been written to cover all phases of work usually encountered on contracts and may therefore cover items of work not encountered in this particular contract.

The Contractor is responsible for ensuring that he is thoroughly familiar with all the amendments and corrections before submitting his tender.

B2. PROJECT SPECIFICATIONS REFERRING TO THE STANDARD SPECIFICATIONS AND ADDITIONAL SPECIFICATIONS

The standard specifications provide, in certain clauses, for a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternatives or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains some additional specifications required for this particular contract.

The number of each clause and each payment item in this part of the project specifications consists of the prefix B followed by a number corresponding to the number of the relevant clause or payment item in the standard specifications. The number of a new clause or a new payment item, which does not form part of a clause or a payment item in the standard specifications and is included here, is also prefixed by B followed by a new number. The new numbers follow on the last clause or item number used in the relevant section of the standard specifications.

B3. SECTION B1200: GENERAL REQUIREMENTS AND PROVISIONS

B1204 PROGRAMME OF WORK

a) General requirements

Add the following as a continuation of the first paragraph:

“In drawing up the programme the contractor shall make allowance for the following:

- i) All special non-working days such as public holidays and contractor’s holidays.
- ii) The expected delays defined in B1215: Extension of time resulting from inclement weather.

This initial indicative programme shall realistically account for the forecast cash flow within the defined contract period, if an alternative contract period is offered; the contractor shall submit a separate programme with the alternative tender.”

b) Programme of work for construction work

Insert the following after the first sentence of the second paragraph:

“The programme shall include the following details:

- i) A work breakdown structure that identifies all major activities.
- ii) Scheduled start and end dates for each activity.
- iii) Linkages between activities that clearly identify sequence, floats and critical path.
- iv) Intended working hours and resource allocations (plant and labour).
- v) Monthly cash flow projections.
- vi) Key dates in respect of information required or due delivery.”

Add the following sub-clause:

“c) Programme revisions

The programme will be reviewed at the monthly site meetings at which the contractor shall provide sufficient detail that will allow the comparison of completed work per activity against the original approved programme. The contractor shall indicate what resources and programme changes he intends to implement in order to remedy any activity that has fallen behind. The Engineer may demand from the contractor a major revision of the programme. Such a revision shall be submitted for approval within fourteen days of the demand.”

Add the following after the title:

“The contractor shall implement a quality assurance system in accordance with ISO 9002 and appoint a quality manager who shall ensure that members of the contractor’s staff comply with the requirements of the quality system. The quality system and the methods used to implement it shall be described in a quality plan produced by the contractor.

The quality manager shall be resident on site full time. No construction activities shall take place on site before the Engineer approves the quality plan”.

Delete the second, third, fourth and fifth paragraphs and replace with the following:

“The contractor shall submit the quality assurance system he proposes using to the Engineer, for his approval, within two weeks of the site handover. Once accepted by the Engineer the contractor shall not deviate from it unless written notification of proposed changes have similarly been submitted and approved. The system shall record the lines and levels of responsibility and indicate the method by which testing procedures will be conducted.

As the Contractor’s process control will be used for acceptance purposes, the minimum intensity and type of the control testing shall be as stipulated in Section 8300 (scheme 2). The following minimum sampling and testing shall be carried out:

TABLE B1205 – MINIMUM SAMPLING AND TESTING FREQUENCIES

| COMPONENT | PROPERTY | MINIMUM SAMPLES AND TESTS PER LOT |
|-------------------------|----------------|-----------------------------------|
| Concrete for structures | Cement content | 1 |
| | Slump test | 1 |
| | Cube strength | 1 (3 cubes) |

B1207 NOTICES, SIGNS AND ADVERTISEMENTS

Remove this part of the sentence from the first paragraph

“... or as approved advertisements for the contractor’s establishment.”

Delete the third paragraph and replace with the following:

“All signboards erected in accordance with the drawings shall be removed at the same time as the disestablishment of the contractor’s camp. Payment under subitem 13.01 for the final instalment of 15% of the tendered lump sum shall not be made unless all the advertisements, notices and temporary signs have been removed. A typical signboard layout is shown in the Tender Drawings”

B1209 PAYMENT

(b) Rates to be inclusive

Add the following to the first paragraph:

“VAT shall be excluded from the rates.”

“(g) Work in confined areas

Except where provided for in the specification and the Pricing Schedule no extra payment shall be made nor shall any claim for additional payment be considered for construction in confined areas. The omission of

standard pay items from the schedule of quantities shall be taken to be deliberate and any additional costs incurred shall be included in the bulk rate.”

B1210 CERTIFICATE OF PRACTICAL COMPLETION OF THE WORKS

Add the following paragraphs after item (h):

“Notwithstanding that there might be natural or programmed sections of the works that will result in them being completed in their entirety before other sections, no consideration shall be given to the issuing of practical completion certificates for portions of the works.

In addition to the listed specified items of work and regardless of the degree of beneficial occupation by the Employer, the works shall be considered for practical completion only if the following criteria also have been met:

- (i) The estimated cost to complete the outstanding work is less than 2% of the tendered value of work plus the cost of any variation or extra work orders, but excluding VAT.
- (ii) The written list of outstanding items of work can be completed within 28 days of the list having been accepted in writing by the contractor.
- (iii) Any information in the contractor’s possession, which is required by the Engineer and has been requested in writing, has been supplied.”

The contents of this clause 1210 of the COLTO Standard Specifications, together with the above amendment, shall apply equally to the issue of a Certificate of Completion.

B1214 CONTRACTOR’S ACTIVITIES IN RESPECT OF PROPERTY OUTSIDE THE ROAD RESERVE AND OF SERVICES MOVED, DAMAGED OR ALTERED

Under sub-clause (e) replace the opening paragraph with:

“Should the contractor use land not provided by the Employer for the purpose of his own establishment, Engineer’s offices or storing of equipment or materials required for construction or disposal, it shall be subject to the following:”

and add the following sub-sub-clauses:

- “(vi) That lease agreements are concluded with the owner or owners of such land for the full period that such areas are required. The leases shall provide for possible extensions to match the duration of the contract. The lease agreements shall also provide for the contract being terminated by contractor’s default or liquidation and the resulting possibility for them to be taken over by a succeeding contractor.
- (vii) That copies of lease agreements shall be submitted to the Engineer prior to signature by the signing parties, and copies lodged with the Engineer after signing. Notwithstanding the Engineer’s approval of the conditions of a lease the contractor shall be solely responsible for adherence to the terms of the agreements.
- (viii) Adherence to the principles of the environmental management plan and legal obligations”.

B1215 EXTENSION OF TIME RESULTING FROM INCLEMENT WEATHER

As work is to be conducted indoors it is not expected that extension of time resulting from inclement weather will be required. Contractor must show influence on critical path program.

Inclement weather delays for which the contractor must make allowance in his programme have been derived from previous experience of wind and temperature influence on similar construction in the area of the site.

Actual extensions of time due to inclement weather shall be agreed between the Engineer's and contractor's representatives on the site. The agreed whole days or parts thereof shall be recorded at the monthly site meetings. Adjustment to the contract period shall only be made at the end of the contract when the contractor may submit its claim for the agreed extension due as well as any additional payment resulting from the delay.

Extension caused by inclement weather delays will only accrue once the agreed cumulative delays exceed 5 days.

If approved extensions of time extend the completion date beyond the start of the contractor's holiday in December, the holiday period shall not be considered as working days. Any remaining extension of time at this date shall be calculated from the first statutory working day in January the following year, provided that the contractor has shown in his programme that he intends to close during the traditional Christmas/New Year break."

B1229 SANS CEMENT SPECIFICATIONS

Add the following to this clause:

"Where reference is made in this specification or the standard specifications to the cement specifications, e.g. SANS 471: Portland cement and rapid hardening Portland cement, it shall be replaced with the new specification:

SANS 50197-1: 2000: Cement compositions, specifications and conformity criteria Part 1: Common cements."

Add the following Clause:

"B1230 MATERIALS

The contractor, when using materials that are required to comply with any standard specification, shall, if so ordered, furnish the Engineer with certificates showing that the materials do so comply.

Where so specified, materials shall bear the official mark of the appropriate authority. Samples ordered or specified shall be delivered to the Engineer's office on the site free of charge.

Where materials are specified under trade names tenders must be based on these materials. Alternative materials may be submitted as alternative tenders and the Engineer may, after receipt of tenders, approve the use of equivalent materials. The tender must be clearly marked as an alternative tender, failing which the tender may be rejected.

Unless otherwise specified, all proprietary materials shall be used and placed in strict accordance with the relevant manufacturer's current published instructions.

Unless anything to the contrary is specified, all manufactured articles or materials supplied by the contractor for the permanent works shall be unused.

Earth, stone, gravel, sand, and all other materials excavated or present on the site shall not become the property of the contractor, but will be at his disposal only in so far as they are approved for use on the contract.

Existing structures on the site shall remain the property of the employer and except as and to the extent required elsewhere in the contract, shall not be interfered with by the contractor in any way.

Materials to be included in the works shall not be damaged in any way and, should they be damaged on delivery or by the contractor during handling, transportation, storage, installation or testing they shall be replaced by the contractor at his own expense.

All places where materials are being manufactured or obtained for use in the works, and all the processes in their entirety connected therewith shall be open to inspection by the Engineer (or other persons authorised by the Engineer) at all reasonable times, and the Engineer shall be at liberty to suspend any portion of work which is not being executed in conformity with these specifications.

The contractor shall satisfy himself that any quarry selected for use provides the necessary mined material in accordance with the specification."

B1231 MEASUREMENT AND PAYMENT

Add the following new payment items:

Item Unit "B12.01 Supply and erection of contract sign boards Number (No.)

The unit of measurement shall be the number of sign boards supplied and erected on the site.

The tendered rate shall include full compensation for furnishing and erection of the sign boards as detailed on the drawings, complete with supports and the dismantling and removal thereof on completion of the contract.

B4. SECTION B1300: CONTRACTOR'S ESTABLISHMENT ON SITE AND GENERAL OBLIGATIONS

B1303 PAYMENT

B13.01 The contractor's general obligations

Add the following new payment items:

| Item | Unit |
|--|------------------|
| B13.03 Screening and Protection | |
| (a) Dust mitigation around Ground Floor Laboratory | lump sum (L/sum) |
| (b) Dust mitigation to adjacent tanks | lump sum (L/sum) |
| (c) Miscellaneous make-safe measures below first floor | lump sum (L/sum) |
| (d) Miscellaneous make-safe measures above first floor | lump sum (L/sum) |

The tendered lump sums shall include full compensation for performing the tasks as described.

Delete the third paragraph commencing "Should the final value of the work".

In the 11th paragraph, the following amendments apply:

- Start the paragraph to read "The tendered rate per month for all time related payitems represent full compensation ..."; and

Add the following at the end of sub-clause (b) of the 11th paragraph:

"... Such limitations to payments shall occur whenever the ratio of time to expenditure varies by more than 10%. For example, if payment for completed scheduled work is 30% of total scheduled work but more than 40% of time has expired, this payitem shall cease to be active until the difference between the relevant ratios is less than 10%."

Add the following new paragraphs:

"Should the combined total tendered for subitems (a), (b), and (c) exceed 20% of the tender sum (excluding CPA, contingencies and VAT), the tenderer shall state his reasons in writing for tendering in this manner.

Payment for time related costs arising from extensions of time granted by the employer, where the contractor is fairly entitled to such compensation which will be calculated by taking account only of payitems for which the unit of measurement is "month". All payitems for which the unit of measurement is "month" are deemed to be based on 23 working days per month."

Insert the following paragraphs:

"The tendered rate shall apply in the same manner as pay subitem B13.01(c). A contractor who tenders zero for this payitem shall not be relieved of his statutory obligations. A nil rate offered shall be deemed not as an omission but as deliberate notice that costs have been included in the tendered rates for individual items of work or in the other preliminary and general payitems."

**B5. SECTION B6100: FOUNDATIONS FOR STRUCTURES
B6511 MEASUREMENT AND PAYMENT**

| Item | Unit |
|---|---------------|
| 61.13 Dowel bars (type, diameter and length of dowel bars, together with type of grout, indicated) | kilogram (kg) |

The unit of measurement for the dowel bars shall be the kilogram of bars provided and secured in position.

The tendered rate shall include full compensation for supplying all the material and positioning and grouting the dowel bars as specified.

B5. SECTION B6200: FALSEWORK, FORMWORK AND CONCRETE FINISH

B6204 DESIGN

(b) Falsework

Add the following:

"Although the Contractor is free to select suitable arrangements for the support work, the arrangements shall be subject to acceptance by the Engineer. Should the Engineer consider the proposed arrangement unsuitable, the Contractor shall be required to amend and resubmit alternative arrangements acceptable to the Engineer. The Contractor shall not be entitled to additional payment or extension of time arising from the Engineer's rejection of his proposals.

Unless instructed otherwise by the Engineer, the Contractor shall submit his design criteria and detailed drawings of the support work to the formwork for the Engineer's consideration and acceptance. The design, signing of the drawings and inspection of the support work prior to construction of the permanent works shall be undertaken by the Contractor's competent person, who shall be a professional Engineer with the relevant experience.

Notwithstanding anything to the contrary contained or implied in the Conditions of Contract, the Contractor takes sole responsibility for the safety and adequacy of the falsework and formwork in accordance with clause 6203 of the Standard Specifications. Approval and/or acceptance given by the Engineer for such designs and drawings will be subject to the provisions of clause 1221 of the Standard Specifications."

B6205 CONSTRUCTION

(b) Formwork

(ii) Formwork to exposed surfaces

“The formwork at construction joints shall have moulding strips 25mm x 25mm neatly butted and set at the position of the construction joint. The arrangement of formwork and boards is required to present a neat and regular appearance. The Contractor is required to submit his proposed arrangement to the Engineer for approval.”

B6207 FORMED SURFACES: CLASSES OF FINISH

Add the following:

“Steel forms for Class F3 surface finish shall only be used with the written approval of the Engineer and then only if:

- (i) the forms are in good condition, free of rust, dust and any other foreign material which would result in staining of the formed surface
- (ii) any resulting depressions and projections which occur in the formed surface do not exceed 3mm when measured with a straight edge placed between joint lines created by the forms
- (iii) the edges of forms are straight and flat to ensure that forms butt without forming gaps along the joints and that steps and hollows at the joint lines do not occur.”

B6. SECTION B6300: STEEL REINFORCEMENT FOR STRUCTURES

B6302 MATERIALS

(e) Steel Bars

Add the following before the first paragraph:

“Unless specified or directed otherwise by the Engineer, all steel reinforcing bars shall be either high yield stress hot-rolled deformed bars (Y-bars) or mild steel hot-rolled plain round bars (R-bars) as indicated on the drawings. Cold-worked reinforcing bars will not be permitted.”

Add the following paragraph:

“Substitution of mild steel reinforcement as indicated on the drawings by an equivalent area of high yield stress reinforcement or vice versa will not be permitted.”

B6306 PLACING AND FIXING

Replace the second and third paragraphs with the following:

“The concrete cover for all structural concrete shall be as specified on the drawings within a tolerance of -5/+10mm. Prior to fixing the steel, samples of the proposed spacers shall be submitted to the Engineer along with a written statement for in-situ manufacture, if applicable, for approval.

Overlap of steel reinforcement bars shall be such that the cover to the lapped bars remains constant at the specified cover.” *Add the following:*

“Steel bars shall be spaced accurately in accordance with the drawings to comply with the following tolerances:

Specified spacing 200mm and less: $\pm 10\text{mm}$

Specified spacing greater than 200mm: $\pm 15\text{mm}$ ”

B6307 COVER AND SUPPORT

In the second paragraph replace the second sentence, commencing with

"Where no cover is indicated...shown in Table 6306/1" with the sentence "Where no cover is indicated, the Contractor shall inform the Engineer who shall after consultation with the design engineer indicate the required cover in writing and the as-built drawings shall indicate such cover".

Add the following to the end of the fifth paragraph:

"Concrete cover and spacer blocks shall be made using the same cement and aggregate type as the main concrete with the same water/ cement ratio so that differences in shrinkage, thermal movements and strain are minimised. Cover blocks shall be water cured by submersion for a minimum of 7 days and thereafter kept submerged in water until immediately before fixing onto reinforcing steel. Where concrete cover blocks, subsequent to fixing, have visually dried out they shall be remoistened by an appropriate method so that they are damp before the placing of concrete. Only semi-spherical concrete cover blocks shall be used. Where fixing wire is inserted into cover blocks, it shall be galvanised. Cover and spacer blocks manufactured from other materials e.g. plastic or wood shall not be permitted. All cover blocks regardless of the type of material manufactured from, shall not be visible on exposed concrete surfaces."

B7. SECTION 6400: CONCRETE FOR STRUCTURES

B6402 MATERIALS

(a) Cement

Replace the colon at the end of the first paragraph with a comma and add the following:

"taking into account the adoption of the new SANS 50197-1:2000 code for cements: (refer to C&CI website www.cnci.org.za)".

Add the following paragraphs:

"The type of cement to be used in any concrete element shall take into account the environmental conditions and durability requirements at the location of the site of the works and shall be as approved by the Engineer.

With the exception of the standard SANS approved cement blends supplied by the primary cement producers, the blending of cement and extenders shall not be permitted unless specifically approved by the Engineer based on an acceptable quality assurance procedure. The source of supply for each type of cementitious material shall not be changed during the contract period.

The Contractor shall submit certificates from the supplier indicating compliance with the requirements of SANS 1491 for any cement extenders used in blending the cement.

Test certificates from an approved laboratory shall be furnished by the Contractor for all cements and prior to their use in the works, indicating the alkalinity of the cement expressed as the percentage sodium oxide equivalent ($\%Na_2O + 0,658(\%K_2O)$). Cement with such an alkalinity content in excess of 0,60% shall only be used with the written authority of the Engineer regardless of whether or not the aggregates are considered to be potentially alkali reactive."

(b) Aggregates

Replace the 2nd last paragraph of sub-clause (i) with the following:

"The aggregates used in all structural concrete for this contract shall be from approved sources known to produce aggregates with low shrinkage and low water demand characteristics. Test certificates from an approved laboratory shall be furnished by the Contractor for all aggregates and prior to their use in the works indicating compliance with the above limiting shrinkage values."

Add the following new sub-sub-clauses:

"(vi) The maximum chloride ion content of fine aggregate shall be 0,03% by mass of aggregate as measured by SANS 1083:2002.

Where concrete is situated in a chloride environment as determined by the Engineer, the value shall be reduced from 0,03% to 0,01%.

(vii) Test certificates from an approved testing authority shall be furnished by the Contractor for all aggregates and prior to their use in the works, indicating the potential alkali-silica reactivity. Where, in the

opinion of the Engineer, any aggregate shows potential reactivity, then the use of such an aggregate in the works shall only be permitted if the total alkali content of the concrete as determined from all its constituents does not exceed between 2,1 kg/m³ to 2,8 kg/m³ depending on the assessed severity of the potential reactivity of the aggregate, and then only with the written authority of the Engineer.

(viii) The grading of the fine aggregate shall in addition to the requirements in SABS 1083 also comply with the grading limits in the following table:

GRADING OF THE FINE AGGREGATE

| Sieve size (mm) | Cumulative percentage passing sieve |
|-----------------|--|
| 4,75 | 90 - 100 |
| 2,36 | 75 - 100 |
| 0,18 | 60 - 90 |
| 0,60 | 40 - 60 |
| 0,30 | 20 - 40 |
| 0,15 | 10 - 20 |
| 0,075 | Natural sand 5 – 10 Crusher sand 5 - 20 |

Blending of fine and coarse sands will be permitted where necessary to achieve the above grading limits for fine aggregate.”

(d) Water

Add the following:

“Water for concrete, other than for prestressed concrete, shall not contain chlorides calculated as sodium chloride in excess of three thousand parts per million (3000ppm) nor sulphates calculated as sodium sulphate in excess of two thousand parts per million (2000ppm).

Water for curing concrete shall not contain impurities in sufficient amount to cause discolouration of the concrete or produce etching of the surface. No sea-water or water containing salts shall be used.”

(e) Admixtures

Add the following sub-sub clauses:

(v) Only admixtures of the type that do not increase the water demand of the mix will be considered by the Engineer.

(vi) Admixtures, which have a retarding effect on the rate of hydration of the cement, may not be used when the concrete temperature is below 20°C.

(vii) A retarding admixture shall be used if temperatures of concrete mixes using cements of strength class 42.5 or higher is between 20 to 30°C or where the ambient temperature is between 20 and 30°C.”

(f) Curing agents

Add the following:

“Full technical specifications and product data sheets as well as samples of not less than 1 litre of the proposed curing agents shall be submitted to the Engineer for approval, and no curing agent shall be used until approved by the Engineer.”

(a) General

Replace the first paragraph with the following:

“All concrete in the Works shall comply with the requirements for strength concrete as specified in sub-clause 6404(b).

(b) Strength Concrete

Add the following:

“Concrete mix designs complying with the specifications shall be submitted to the Engineer for approval at least two weeks prior to casting the concrete and shall for each mix include the following:

- Target strength and slump
- 7 and 28 day compressive strength results with measured slumps
- Cement source, type and composition
- Test results for mixing water, see COLTO clause 8116
- Brand and dosage of any admixtures
- Proportions of all constituents in the mix
- Cement quality certificates including Na₂O equivalent
- Certificates of compliance iro any cement extenders used (SANS1491)
- Data sheets for admixtures
- Aggregate source and test results to confirm compliance with SANS 1083, including grading, flakiness and FM
- Shrinkage characteristics and potential alkali reactivity of fine and coarse aggregate
- Results of the concrete drying shrinkage (Colto clause 6402(b)(i)(3)).

No concrete mix designs will be considered for approval until all the above-mentioned data has been submitted and no concrete may be placed until such time that the concrete mix has been approved by the Engineer.

(d) Consistence and workability

Add the following:

“On-site slump cone test measurements for all structural concrete used in the works and taken at the time of actual placing shall fall within the range 75±25mm. Concrete which has a slump outside of this range shall not be placed in the structure and removed immediately from the site.”

B6406 MIXING

(f) Ready-mixed concrete

Add the following:

“Delivery tickets for all ready-mixed concrete delivered to site shall be checked prior to discharge to ensure the correct mix has been delivered and the time of arrival recorded and compared to the time of batching to ensure consistency with the expected travel time and that no undue delay has occurred between dispatch and delivery.

The temperature limits at the point of delivery shall be as specified in SANS 878:2004 unless the Engineer has specified other limits due to specific design requirements.

No water shall be added on site prior to placing the concrete to improve workability. Prior to placing all concrete delivered to site shall be checked for workability using the slump cone test and slump measured outside of the limits set for the design mix shall be rejected and removed from the site.

The rate of change in concrete properties shall be closely monitored. When, in the opinion of the Engineer, the workability drops to the extent that the concrete cannot be satisfactorily placed and compacted with the

available equipment and manpower it shall be deemed unsuitable for use and removed from the site of the works. Under no circumstances shall water be added to maintain or reinstate workability.

No admixtures shall be added on site before or during placing the concrete to improve or maintain workability.”

B6408 CONSTRUCTION JOINTS

(a) General

Add the following:

“No construction joints other than those indicated on the drawings will be permitted without the written approval of the Engineer. In all cases the proposed method of forming the joint shall be discussed and agreed with the Engineer.”

B6409 CURING AND PROTECTION

Add the following to the end of sub-clause 6409(f):

“Where a curing compound is used, it shall consist of an approved water based low viscosity clear wax emulsion applied in accordance with the manufacturer’s instructions.”

Add the following paragraphs to the end of this sub-clause:

“Where curing by retention of formwork is used as the only method of curing the concrete, it must be left in place for the minimum period specified in Table 6206/1 but in no instance shall it be less than 7 days.

The materials used for formwork shall take into account properties such as thermal insulation and moisture absorption when assessing the suitability of the material, to the approval of the Engineer.

If impermeable curing membranes are to be used as a curing method, they shall be installed at the same time as formwork is removed and no portion of a concrete surface may be left unprotected for a period in excess of 2 hours. If the surface is an unformed finish e.g. top of deck slab, then the surface must be protected immediately by appropriate methods approved by the Engineer after it is finished, without damage to that surface, since it is vulnerable to plastic shrinkage and plastic settlement cracking due to high rates of evaporation while the concrete is still in a plastic state. Plastic shrinkage and settlement shall not be permitted on any of the structural elements since it compromises the durability of the concrete. In order to prevent early settlement and shrinkage of the concrete, the concrete placed shall be re-vibrated after initial compaction while the concrete is still in a plastic state. Any remedial measures shall be as approved in writing by the Engineer.

B6410 ADVERSE WEATHER

(b) Hot weather

Add the following at the end of this clause:

“Placing of concrete during dry, hot and windy conditions irrespective of ambient temperature will not be allowed unless fully motivated in exceptional circumstances and expressly permitted under the special precautionary measures approved by the Engineer.” *Add the following sub-clause:*

(d) Temperature and hydration of concrete

“The temperature of concrete when placed shall be within the range 10°C to 30°C. Concrete which has a temperature outside of this range shall not be placed in the structure. Care shall also be taken not to cast concrete onto hot steel shutters as this might induce cracking.

The rate of hydration of the cement in the concrete shall be such that the concrete can be placed and properly compacted within 2 hours after the addition of water to the mix ingredients. The initial set of the concrete shall not be unduly delayed due to inappropriateness of admixtures or cement type, which could promote bleeding.”

B6414 QUALITY OF MATERIALS AND WORKMANSHIP

(a) Criteria for compliance with the requirements

Add the following:

“Routine inspection and quality control will be done by the Engineer as specified in Section 8300. All reference in clause 6414 to Section 8200 and its clauses or sub clauses shall be deleted.”

B7. SECTION B6700: STRUCTURAL STEELWORK**B6701 SCOPE**

Add the following:

“This section also covers the supply of all materials, fabrication, transport and erection of all structural steelwork associated with the conveyor support to be erected under this contract.

For additional requirements in respect of Materials, Shop Drawings, Quality Plan & Control, Welding, Fabrication, Corrosion Protection as well as Inspections and Testing reference shall be made to the specifications included on the relevant steelwork drawings.”

B8. SECTION B8100: TESTING MATERIALS AND WORKMANSHIP

Add the following clause:

“B8118 PROPRIETARY RESINS, GROUTS AND MORTAR

All proprietary cementitious and epoxy resin, grouts and mortars shall comply with the manufacturer’s specifications. The manufacturers or suppliers shall provide recent test reports from an approved laboratory to prove such compliance and shall also provide test certificates of recent tests on the materials.

Cementitious grouts and mortars shall not contain expansive cements or metallic powders such as aluminium or iron filings. The plastic volume change shall fall in the range between zero shrinkage and 4% expansion from the time of placement until final set when tested according to ASTM C 827. Further, the grout shall show no shrinkage and a maximum of 0,2% expansion in the hardened state when tested according to ASTM C 1090.

Epoxy resin grouts and mortars shall show no shrinkage and a maximum 2,0% expansion from the time of placement when tested according to ASTM C 827 (modified). The coefficient of thermal expansion shall not exceed 0,000055/°C when tested according to ASTM C 531.

The manufacturer shall submit to the Engineer samples of the proposed materials together with complete technical details including mixing ratios and times, pot life, setting and curing times, strength, volume change, thermal expansion, creep characteristics etc.

As part of the Contractor’s process control in terms of sub-clause 8103(a), testing shall be undertaken on the materials delivered to site to monitor compliance with the manufacturer’s specifications. All new batches of materials shall be tested by the Contractor and approved by the Engineer prior to incorporation into the works.

Strength testing shall be undertaken, using 75mm or 100mm cubes, on samples taken from the mixed material actually being used in the work at the time of its use.”

B9. SECTION B8300: QUALITY CONTROL (SCHEME2)**B8301 SCOPE**

Add the following:

“Quality Control (Scheme 2), as described in Section 8300 will be applicable for the testing and control of properties of materials and workmanship.”

B10. SECTION 8400: PAINTING

SECTION B8400: PAINTING

B8402 MATERIAL

Add the following:

“The painting system for corrosion protection of all steelwork shall be Carboline coating system supplied by StonCor Africa comprising:

- (a) One coat of shop applied ‘Phenoline 921’, DFT 250 micron
- (b) One coat of site applied ‘Phenoline 921’, DFT 250 micron, colour to Engineers Approval”

B8404 APPLYING THE PAINT

Add the following:

“Protective coating to concrete surfaces:

Apply ABE QuickSpray Supreme HP coating (VIP Coating Solutions). Surface preparation, mixing and application shall be carried out strictly in accordance with the manufacturer's specification.”

B8412 MEASUREMENT AND PAYMENT

Add the following payment item:

| “Item | Unit |
|---|--------------------|
| B84.02 Protective coating to concrete surfaces (full description of system and part of square metre (m₂) structure indicated) | and part of |

The unit of measurement shall be the square metre of surface area prepared and coated as specified and accepted by the Engineer.

The tendered rate shall include full compensation for the supply and storage of materials on site and for all labour, plant and tools and for all work and incidentals required to complete the surface preparation of the coating and application as specified.”

B11. SECTION 12 100: ACCESS FOR BRIDGE REHABILITATION

F12 101 SCOPE

This specification covers the requirements for the provision of suitable and safe access to all areas requiring concrete demolition, repair work or rehabilitation of bridges/structures in accordance with the contract, and for inspections by the engineer.

This specification shall be read with the COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998 edition), in particular Section 1200: General Requirements and Provisions, and Section 1300: Contractor’s Establishment on Site and General Obligations of the Standard Specification.

F12 102 INTERPRETATION

(a) Supporting specifications

The following specifications shall be read with, and shall form part of the contract:

- COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998 edition).
- SABS and BS standards referred to in this specification.

(b) Definitions

(i) Temporary works

The temporary works necessary for access to the work area includes all foundations, scaffolding and support structures, working platforms, cradles, fixtures to existing structural members, etc required for the safe access to and execution of the work, and for the protection of passing persons, animals and vehicles against injury or damage and prevention of damage and littering to the environment.

(ii) Mobile access unit

A mobile access unit consists of a vehicle-mounted access gantry and work platform, including mobile crane type units.

(iii) Location

Location means the site as a whole where rehabilitation work has to be done.

(iv) Structural element

Setting up at each structural element as measured in the pricing schedule shall include all movement from point to point on a particular element. Structural elements are abutments, piers, decks and parapets/balustrades/edges of deck only. **Other parts of a structure shall be deemed to be included in the structural element to which they are most closely associated. A pier, abutment, deck or balustrade/parapet/ edge of deck may comprise single or multiple elements.**

F12 103 GENERAL REQUIREMENTS

The contractor shall provide and will be responsible for safe access structures and work platforms to all areas requiring remedial work. The access and temporary works shall be designed, constructed and maintained in accordance with the current relevant safety regulations, all in compliance with the Occupational Health and Safety Act (Act 85 of 1993) and its applicable Regulations, and shall remain in place until removal is authorised by the engineer. Appropriate allowances shall be made for screening of the work and other protective measures required by the various work activities.

Access and work platforms may be provided from overhead mobile access gantries or vehicles, or from temporary works supported from the ground or fixed to structural members. The design and erection/construction of such temporary works shall be certified by a professional engineer on behalf of the contractor to comply with the relevant safety regulations regarding strength and stability for all imposed loads that can be anticipated to arise from the specified work activities.

Notwithstanding approval given by the engineer for the design and drawings prepared by the contractor and the acceptance of temporary works including the working platform(s) and access structure(s) as constructed, the contractor shall be solely responsible for the safety and adequacy of the temporary works and shall indemnify and keep indemnified the employer and engineer against any losses, damage to persons or property, all claims, demands, proceedings, damages, costs, charges and expenses whatsoever, which may arise out of or in consequence of the design, construction, use and maintenance of the temporary works.

Abseiling techniques shall not be allowed.

The contractor shall comply with any additional imposed or physical restraints upon the means of access to and from the structure as stated in the project specification and/or the drawings.

The contractor shall provide access facilities for inspection and testing by the engineer, including the inspection at the end of the maintenance period. Any specific access facility required for the inspection at the end of the maintenance period shall be as specified in the pricing schedule.

F12 104 MATERIAL

All timber, structural steel and scaffolding used shall be free from defects that may prejudice the stability of the working platform(s) and access structures. The jacks, devices, clamps and fittings shall all be in good working order and of adequate design and strength.

The type, grade and condition of the material shall be subject to the engineer's inspection.

F12 105 PLANT AND EQUIPMENT

(a) Mobile access units

Access structures and work platforms mounted and operated from a mobile vehicular support base shall be of an approved type and capacity for the intended use. The unit shall at all times be operated within the recommended limits in terms of reach and capacity as stated by the manufacturer or the authority responsible for the operation and maintenance of the access unit.

The contractor shall, prior to dispatching the mobile access unit to the site, provide certification from the manufacturer or the operating authority that the unit has been thoroughly inspected and serviced, that the unit is functioning properly and that it complies with the relevant safety regulations.

(b) Scaffolds, platforms and cradles

Temporary works entailing scaffolds, platforms and cradles providing access to the work area shall be assembled and constructed from materials and structural sections complying with the relevant specifications. The temporary works shall be designed, erected, operated, maintained and dismantled so as to ensure safe working conditions for all site personnel, and where necessary the safety of the general public having access to the site.

F12 106 CONSTRUCTION

All temporary access structures and work platforms and associated works shall be erected, modified, maintained, and dismantled under the direction of an experienced and competent supervisor or safety officer.

Prior to using any temporary access structure or facility, and at regular intervals thereafter, or following unforeseen circumstances, the temporary works shall be inspected and certified by a suitably experienced and qualified person on behalf of the contractor.

To ensure the safety of, and to prevent injury or damage to passing persons, vehicles, animals, etc the temporary works shall be enclosed with a suitable screening membrane or boarding where necessary to contain material or work equipment within the limits of the restricted work area.

Suitable debris containers and chutes shall be provided to assist in the removal of debris and unusable or rejected materials.

Where temporary works are to be fixed to, or supported from an existing permanent structure, the location shall be subject to the approval by the engineer. Such temporary works shall be removed when the work is completed and any holes, surface damage or blemishes arising from the fixture shall be repaired to the surface finish of the adjacent surface to the satisfaction of the engineer.

F12 107 MEASUREMENT AND PAYMENT

The payment items in this clause shall include full compensation for all works items associated with the provision of suitable and safe access to all areas on site which are not already covered by the measurement

and payment items of the Standard Specifications, i.e. all temporary works related to access structures and work platforms, or mobile access units including associated plant, equipment and labour.

| Item | Unit |
|--|-------------|
| F121.01 Temporary access structures and work platforms | |
| Access and platform to (height range indicated) | |
| (i) Design, supply and erect at the following structural elements and height ranges inclusive of dismantling and moving to the next structural element | lump sum |
| (ii) Dismantle and remove from location or structure | lump sum |

The unit of measurement for each subitem shall be lump sum.

The height range shall be measured from the average ground surface to the agreed height limit accessed from the work platform.

The height range shall be measured in the following height bands:

- 0m up to 5,0m
- Exceeding 5,0m up to 10,0m
- Exceeding 10,0m up to 20,0m
- Etc. in increments of 10m height

The tendered amount shall include full compensation for design, supply, fabrication, erection, dismantling, movement and for all labour, materials, and equipment required for the above works including the inspections, supervision by the safety officer and maintenance of the temporary access structure and work platform.

The amount shall also include for all temporary traffic accommodation required during the deployment of the access equipment.

Payment shall be made on completion of each subitem.

| Item | Unit |
|--|-------------|
| F121.03 Access at end of maintenance period (Description of location) | lump sum |

The unit of measurement shall be the lump sum for access to each site at the end of the Defects Liability Period as ordered by the engineer.

The tendered amount shall include full compensation for all labour, material, plant or equipment including plant operators required to provide suitable and safe access for the engineer to carry out the necessary inspections as measured in the pricing schedule.

B12. SECTION 12 200: DEMOLITION AND REMOVAL OF STRUCTURAL CONCRETE

F12 201 SCOPE

This specification covers the work in connection with the demolition of entire members of a concrete structure as well as cutting back concrete to expose reinforcement and the initial preparation of the exposed surface. Surface and structural repair of concrete members is covered in Section 10 300.

F12 202 INTERPRETATION

(a) Supporting specification

The following specifications shall be read with, and form part of the contract:

- (i) Project Specification
- (ii) COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998 edition)
- (iii) SABS and BS standards referred to in this specification

(b) Definitions

(i) Concrete members

All references to concrete members shall include mass concrete, un-reinforced, reinforced and prestressed concrete members.

(ii) Demolition of concrete members

Demolition means the breaking up and removal of an entire concrete member.

(iii) Removal of concrete

Removal of concrete means cutting back into the surface or end of a concrete member and the removal of unsound, damaged or contaminated concrete, or the partial removal of concrete sections, to expose a sound surface for bonding new material for the repair or extension of the concrete member.

F12 203 MATERIALS

All devices used to remove concrete or to demolish concrete members, shall be handled, stored and used strictly in accordance with the manufacturer's instructions and current safety regulations.

F12 204 PLANT AND EQUIPMENT

(a) General

All plant, equipment, tools and devices used for the demolition of concrete members or the removal of portions of existing concrete shall be based on proven and accepted technology within the industry. The plant, equipment, tools and accessories shall be inspected and maintained on a regular basis to ensure that they remain in good working order, function efficiently, and that safety is not compromised. All cutting and breaking tools shall be kept sharp to reduce the force required to break out concrete to a minimum.

The plant, equipment, tools and devices used for the demolition or removal process shall be of the accepted type and capacity for the relevant application. The suitability of the chosen method shall be demonstrated on a representative test section identified by the engineer prior to the execution of any programmed work.

(b) Access structures and working platforms

Where necessary, the contractor shall provide suitable and safe temporary access structures, working platforms, debris collection and removal chutes and bins, including protection screens where required, at each location where concrete has to be demolished or removed.

The temporary structures, platforms, chutes, etc must be stable and of sufficient strength and rigidity to safely carry the imposed temporary loads arising from the work activity, all as described in Section 12 100.

F12 205 CONSTRUCTION

(a) Sequence of execution

The method and sequence of demolition or removal of concrete shall be in accordance with the drawings or as directed by the engineer and the approved method statement submitted by the contractor following pre-construction testing if necessary.

Any temporary propping specified in the approved method statement and the drawings shall be securely positioned in accordance with each stage of the demolition or removal sequence prior to commencement of the following stage.

(b) Site preparation and access

The necessary access and temporary support structures shall be in place prior to the commencement of demolition or removal of concrete. Screening and protective measures shall be established around the work area as necessary to ensure acceptable environmental, health and safety conditions.

(c) Demolition of concrete members

The demolition of entire concrete structures or major elements of a structure shall employ techniques that do not damage adjacent structures or structural elements, nor contaminate the surrounding environment except during special periods as may be approved by the engineer.

The contractor shall ensure that any nuisance associated with his work activity is minimised by implementing appropriate precautions and measures to the approval of the engineer. Common nuisances associated with demolition and concrete removal include fumes, noise, dust, flying fragments, heat and vibration.

Concrete members which are to be demolished completely shall be broken into suitably sized fragments to allow easy removal from site to an approved dump area.

Recommended demolition techniques include the use of percussion breakers, chisels or other approved mechanical equipment, the use of thermal or hydraulic cutting techniques or by non-explosive chemical means, to ensure minimal damage (e.g. micro-cracking) to the existing concrete. Demolition by explosive means will normally not be acceptable and will be subject to the engineer's written approval. Water jet removal of concrete is preferred wherever feasible.

(d) Removal of concrete from structural elements

(i) Cutting back concrete to a new finished surface

The concrete and reinforcement shall be cut back adequately to provide the prescribed concrete cover to the new finished surface as indicated on the drawings or as directed by the engineer. The technique used shall be suited to its intended purpose and shall not cause damage to the remaining concrete member.

Only techniques that do not damage the inherent structure, bond or strength of the remaining sound concrete shall be used. The thermal cutting technique shall not be used closer than 100mm from the final surface as indicated on the drawings. The remaining concrete shall be removed using approved mechanical equipment or hydraulic techniques.

The fixed exposed contact surface shall be bounded by straight line edges cut at least 10mm deep by a diamond cutting saw, angle grinder or other approved equipment.

(ii) Cutting back concrete to expose reinforcement

Where a concrete member has to be joined or extended or replaced by new concrete, the concrete shall be carefully cut or broken from the reinforcement bars to expose the bars to the dimensions and outline as shown on the drawings or as directed by the engineer. Care shall be taken not to damage or reduce the strength of the exposed bars or concrete member thereby making them unfit for use.

The remaining concrete contact surface shall be cut to a plane and even surface with exposed faces perpendicular to the horizontal face or side faces as applicable.

The bounding lines of the cut concrete shall be straight and neat cut to at least 10mm depth using a diamond cutting saw, angle grinder or other approved concrete cutting equipment.

(e) Removal of metal sections embedded in concrete

Metal sections that are embedded in concrete members by means of grout pockets shall be removed by carefully chipping out the embedment grout filling the pocket. Care shall be taken not to damage the structural concrete surrounding the pocket. Suitable tools such as hand-held power tools with chisel bits or hand tools shall be used.

Following the removal of the metal section, all remaining grout shall be removed and the pocket cleaned out to expose only solid concrete surfaces. The pocket shall be finally cleaned using high-pressure water jetting or oil-free compressed air to remove all loose fragments of grout, or concrete aggregate.

(f) Preparation of exposed contact surfaces (For extension of existing concrete elements or construction of new concrete members)

All loose and shattered concrete, as well as foreign material such as oil, paint, grease, etc shall be removed from the contact surface of old concrete before new concrete is placed. The aggregate must be exposed to provide a good bonding surface.

The mechanically prepared concrete surface shall be cleaned by means of oil-free compressed air or water jetting.

The breaking out and preparation of damaged, spalled and/or cracked concrete surfaces is described and measured under the Sections 12 300 and 12 400.

(g) Disposal of waste material

All waste materials, rubble, scrap and rubbish arising from the contractor's presence on site and/or the execution of the works shall be disposed of weekly to a disposal site identified by the contractor and approved by the engineer.

F12 206 TOLERANCES

The contractor shall remove concrete to a planar, uniform surface with 25mm maximum deviation from the level or dimension indicated on the drawings unless otherwise approved by the engineer. The outer edge of the contact surface shall consist of straight lines with maximum deviation of 5mm from straight, measured with a 1m long straight edge, and shall be within 5mm of the position indicated on the drawings, or as instructed by the engineer.

F12 207 TESTING

The contractor shall carry out pre-construction tests with the proposed equipment to determine the suitability of the technique for the envisaged application. The test results shall be reported to the engineer and shall be subject to the engineer's approval.

F12 208 MEASUREMENT AND PAYMENT

The payitems in this clause shall include full compensation for all work associated with the demolition and removal of concrete structural elements including initial preparation of concrete surfaces or portions thereof which are not already covered by the measurement and payment items of the Standard Specifications or the Project Specification, such as procurement, transport, access and temporary works, plant and equipment required to undertake the work as specified. General access, work platforms and associated temporary works are covered in Section 12 100.

The quantities indicated in the pricing schedule under Section 12 200 are based on the dimensions shown on the drawings and on inspections carried out as part of the preliminary and detail design phases increased to allow for unseen work. It must, however, be accepted that the quantities of work actually done may vary significantly from the scheduled quantities, and that the contractor shall be deemed to have allowed in his tendered rates for such variations in quantities which can be reasonably expected.

| Item | Unit |
|--|----------------------------------|
| F122.01 Demolition of concrete members (location and description) | cubic metre (m ³) |

The unit of measurement is the cubic metre of concrete demolished, measured in its original position and shape based on:

- (i) Full demolition
- (ii) Partial Demolition

The tendered rate shall include full compensation for all labour, material, screening of the structure for safety and environmental protective measures, equipment and plant as well as for all work and incidentals required to complete the work as specified and required to demolish the concrete member and to load, transport and dump the concrete segments and rubble at the nearest approved dumping site. See 12 205(g)

B13. SECTION 12 300: SURFACE AND STRUCTURAL REPAIR OF CONCRETE MEMBERS

F12 301 SCOPE

This specification covers the requirements for the surface and structural repair of structural concrete members. It covers the requirements for the removal of defective or contaminated concrete and/or reinforcement, the preparation of the exposed concrete surface and reinforcement for the rehabilitation of the member, and the repair or replacement of concrete with cementitious mortars, epoxy systems and proprietary concrete repair compounds.

The removal of defective or contaminated concrete, partial removal of concrete sections and the initial preparation of contact surfaces are covered in Section 12 200.

F12 302 INTERPRETATION

(a) Supporting specifications

The following specifications shall be read with and shall form part of the contract:

- (i) Project Specification
- (ii) COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998 edition).

F12 303 MATERIALS

(a) General

In addition to compliance with the requirements of the COLTO Standard Specifications Series 6000, materials shall comply with the relevant requirements of Clause 12 303(b).

(b) Cementitious mortar or concrete

Materials used in the cementitious mortar or concrete shall comply with the following requirements:

- (i) Cement

Cement shall be ordinary CEM.1. (42.5) or CEM.1. (42.5R).

- (ii) Aggregates

(c) Admixtures

Admixtures shall comply with the requirements of ASTM C-194 or AASHTO M-154 and shall be of an approved brand and type.

(d) Epoxy systems

Epoxy systems shall consist of a solvent-free, two-part adhesive consisting of a resin and hardener curing at ambient temperatures. The hardener shall be amine based with a high resistance to moisture. The epoxy shall be supplied and used in accordance with the manufacturer’s instructions and recommendations regarding the intended use thereof. Aggregate for epoxy mortars shall be kiln-dry when mixed with the epoxy system.

TABLE F12303/1: CHARACTERISTIC COMPRESSIVE STRENGTH (MINIMUM) OF EPOXY SYSTEM @ 25°C

| Age (days) | Compressive strength (MPa) |
|------------|----------------------------|
| 1 | 60 |
| 3 | 80 |
| 7 | 90 |

(e) Proprietary cementitious repair compounds

The materials for proprietary cementitious repair compounds shall be supplied as a factory pre-packed dry premix of cements, aggregate and other proprietary products requiring only the addition of pre-packed liquid or a prescribed volume of water of an approved quality to produce the usable repair product. The proprietary repair compound shall compensate for shrinkage in both the plastic and hardened states and shall be suitable for use in the proposed mix and placing techniques.

Proprietary concrete shall be highly workable and self-compacting without the use of vibrators. The aggregate grading shall be designed to prevent segregation during transportation and placing. The concrete system shall have a low alkali content to ensure minimal risk of alkali-silica reaction and shall contain no chlorides. The proprietary concrete shall comply with the material properties as indicated on the detail drawings, alternatively the following shall apply:

TABLE F12303/2: CHARACTERISTIC COMPRESSIVE STRENGTH (MINIMUM) OF PROPRIETARY CEMENTITIOUS REPAIR COMPOUNDS ASTM C-109

| Age | Compressive strength (MPa) |
|---------|----------------------------|
| 3 hours | 12 |
| 1 day | 25 |
| 7 days | 35 |
| 28 days | 40 |

TABLE F12303/3: BOND STRENGTH (MINIMUM) OF PROPRIETARY CEMENTITIOUS REPAIR COMPOUNDS ASTM C-8823

| Age | Compressive strength (MPa) |
|--------|----------------------------|
| 1 day | 10 |
| 7 days | 17 |

Thermal co-efficient of expansion (ASTM C531) 9,0 x 10-6 mm/mm/°C

All the necessary health, safety and fire precautions stated by the manufacturer shall be complied with.

Only material of which the shelf life has not expired shall be used.

(f) Bonding agents

Non-cementitious bonding agents shall be either a single-component emulsion based on modified acrylic type resins or a slow-setting, solvent-free epoxy resin supplied as a two-part material, pre-packaged and ready for on-site mixing and application, and shall be of an approved brand and type suited to the application.

(g) Anti-corrosion primer for reinforcement

The anti-corrosion primer shall be a single component zinc rich primer with a minimum volume solids of 30% complying to a 700 hour salt spray resistance to exposure as per ASTM B-117.

The primer shall be supplied and used in accordance with the manufacturer's instructions and recommendations regarding the intended application. All necessary health, safety and fire precautions stated by the manufacturer shall be complied with.

F12 304 PLANT AND EQUIPMENT

All plant and equipment used for the preparation of concrete surfaces, batching of material and mixing operations shall be in good working order and suited for the intended use. The plant shall be inspected, serviced and calibrated at regular intervals and tested to ensure proper functioning, all to the satisfaction of the engineer.

F12 305 CONSTRUCTION

(a) Preparation of repair surfaces

(i) Preparation of concrete contact surface

All surface laitance and damaged, loose and soft concrete, concrete containing aggressive ions e.g. chloride, as well as all foreign materials such as oil, paint, grease, etc shall be removed from the contact surface using pneumatic chisels or other approved mechanical equipment or thermal/hydraulic techniques. The contact surface shall be treated to expose the aggregate by means of chiselling, sand blasting or high-pressure water-jetting or where it can be shown to produce the required aggregate exposure, a hard brush may be used subject to the engineer's approval.

The mechanically prepared concrete surface shall be cleaned of dust by means of oil-free compressed air or water-jetting.

The area to be repaired shall be bounded by straight line edges cut to the required depth using a diamond cutting saw, angle grinder or other approved equipment. The edges shall be recessed such that the patch has a thickness at the edge of at least twice the maximum aggregate size of the patching material, but in any case not less than 10mm.

(ii) Preparation and protection of embedded reinforcement

All visible or embedded reinforcement bars showing signs of corrosion shall be exposed by cutting back the concrete around the bar with pneumatic chisels or other approved method. The corrosion shall be removed by sand blasting, or where this is not warranted, by wire-brushing with power tools to an acceptable surface. The treated steel surface shall be clean of all corrosion and foreign material likely to impair the bond of the anti-corrosion primer to the reinforcement. No chemical solvents shall be used without the approval of the engineer.

Reinforcement that has experienced significant pitting or reduction in diameter shall be referred to the engineer for acceptance. All rejected reinforcement shall be cut out and replaced with new bars of the same type and size, allowing for a minimum overlap of 45 diameter with the in situ bars.

All exposed and cleaned reinforcement shall receive one coat of a single component anti-corrosion primer based on zinc and epoxy resins, which shall be evenly applied to achieve a minimum 40 µm dry film thickness. The primer shall contain at least 30% zinc solids by volume. The primed surface shall not be exposed to the atmosphere longer than necessary before the application of the repair mortar, but at least until the coating is fully dry.

Alternative proprietary anti-corrosion coatings shall be subject to the approval of the engineer, based on submitted test documentation and proven performance within the industry.

In cases where the final concrete cover is deemed by the engineer to be inadequate the following protection shall be applied at the engineer's instruction:

- Cover 0 - 5mm

The reinforcement shall receive two coats of anti-corrosion zinc-based epoxy primer as described previously. In order to improve the bond to the covering epoxy mortar, kiln-dry quartzitic sand shall be applied onto the final wet coat.

- Cover >5mm

The outer surface mortar patch shall receive a surface coating based on an approved low viscosity cementitious or polymer-based barrier liquid as described in Section 12 600. Where an epoxy mortar is used as repair material, the reinforcement shall be coated as for the 0 - 5mm case.

(b) Bonding layer

(i) Cementitious mortar or concrete repair

Concrete surfaces that exhibit a high moisture absorption shall be wetted prior to patching, the mortar being applied only when the surface has dried sufficiently to have a matt moist appearance, preferably on the dryish side.

The bond of the patching mortar to old concrete may be enhanced by brushing a thick cement paste into the prepared concrete surface before applying the mortar to the fresh paste.

Generally, the cement paste shall consist of one part cement (same type as for patching mortar) and one part sand (<2mm) mixed with water to a thick, but fluid consistency.

The use of polymer dispersive additives to improve workability and bond characteristics shall be subject to the approval of the engineer.

Alternatively, an approved adhesive or bonding agent may be applied to the prepared surface so as to enhance the bond of the fresh mortar to the dry concrete in accordance with the manufacturer's instructions. Only compatible materials shall be used.

(ii) Epoxy mortar repair

The repair surfaces shall be covered with a thin compatible bonding layer of epoxy resin. Should the time interval between resin and mortar application exceed 24 hours, the wet bonding layer shall be sprayed with a kiln-dry quartzitic sand to achieve a sandpaper-like covering. All loose sand shall be brushed off before applying the epoxy mortar to the bonding layer.

(iii) Proprietary cementitious repair compounds

The contact surfaces shall be prepared and treated with a compatible bonding layer in accordance with the manufacturer's specification.

(c) Repair material

(i) Cementitious mortar or concrete

The cementitious repair mortar shall comply with the strength requirements of the concrete in the structural member to be repaired. The water/cement (w/c) ratio shall not exceed 0,5 and guidelines for the composition of mortars and concretes consisting of different aggregate sizes are given in Table 12 305/1.

The contractor shall, however, be responsible for the final design of the repair mix and shall submit a test report by an approved testing laboratory to the engineer for approval prior to its use in the permanent works. All the test results shall be incorporated in the standard concrete mix design approval form (D2).

TABLE 12 305/1: CEMENTITIOUS MORTAR/CONCRETE COMPOSITION: GUIDELINES

| | Layer thickness (mm) | Materials proportions cement: Aggregate (by mass) | Max aggregate size (mm) | Grading limits for aggregate % passing by mass | | | | | | | | | |
|-----------------|----------------------|---|-------------------------|--|----------|----------|----------|-----------|----------|----------|----------|---------|--|
| | | | | mm 0,15 | mm 0,30 | mm 0,60 | mm 1,18 | mm 2,36 | mm 4,75 | mm 10,0 | mm 12,0 | mm 19,0 | |
| Mortar | 0-10 | 1:2,0 to 1:2,5 | 2 | 2 to 10 | 10 to 60 | 50 to 75 | 100 | | | | | | |
| | 10-20 | 1:2,5 to 1:3,0 | 5 | 2 to 10 | 10 to 30 | 25 to 60 | 50 to 80 | 80 to 100 | | | | | |
| Concrete | 20-40 | 1:3,0 to 1:3,5 | 10 | 2 to 10 | 8 to 20 | 20 to 35 | 35 to 55 | 50 to 70 | 70 to 85 | 100 | | | |
| | 40-80 | 1:3,5 to 1:4,0 | 16 | 2 to 10 | 5 to 17 | 10 to 30 | 20 to 40 | 35 to 55 | 50 to 70 | 70 to 90 | 80 to 95 | 100 | |

(ii) Epoxy mortar

The suitability of the epoxy mortar for a particular application shall be proved by testing or submission of an approved industry track record of usage under similar circumstances.

The epoxy mortar shall consist of a waterproofing membrane with a compressive strength equal to or greater than the adjacent concrete and it shall exhibit similar temperature expansion characteristics. The elastic modulus, Ee, shall not exceed that of the parent concrete. Aggregate (fine and coarse) shall be clean and dry and the size shall not exceed one third of the minimum patch thickness.

Guidelines for the composition of suitable epoxy mortars are shown in Table 12 305/2. However, the contractor shall be responsible for the final mix design and shall submit details to the engineer for approval prior to its use in the permanent works.

TABLE 12 305/2: EPOXY MORTAR COMPOSITION: GUIDELINES

| | Layer thickness (mm) | Material proportions cement: aggregate (by mass) | Maximum aggregate size (mm) | Temperature Coefficient of Expansion 10-6/°C |
|---------------|----------------------|--|-----------------------------|--|
| Paste | 0 – 5 | 1:2 - 1:5 | 0,5 | < 30 |
| Mortar | 0 – 20 | 1:8 - 1:10 | 2 | < 20 |
| | >20 | 1:14 - 1:16 | 8 | < 15 |

(iii) Proprietary cementitious repair compounds

The suitability of the repair compound for a particular application shall be proved by testing or submission of an approved industry track record of usage under similar circumstances.

The contractor shall submit details of the proprietary cementitious compounds to the engineer for approval prior to its use in the permanent works.

The repair systems shall be either:

- | | | |
|----|---------------------------|---|
| A. | <u>Repair System 3</u> | Pro-Struct Products |
| | Priming steel surfaces | Pro-Struct 688 |
| | Priming concrete surfaces | Saturate with portable |
| | water Concrete repairs | Pro-Struct 52 |
| | (horiz/vert) | |
| | Curing repairs | Pro-Struct 528 VO(overhead) |
| | | Water ½ hour after initial set |
| B. | <u>Repair System 4</u> | Alternative as proposed by the contractor. |
| | | The contractor shall submit details of |
| | | Repair System 3 to the engineer for approval during the tender period |

(d) Batching and mixing

(i) Cementitious mortar or concrete

The constituent parts of the mortar or concrete, i.e. the cement, aggregate and water, shall be weigh-batched.

Mixing of mortar shall be done with plant or equipment suited to the amount of mortar to be mixed.

The batched materials shall be mixed continuously for at least five minutes in a mechanical drum or table type mixer, or, for small amounts, with an electric drill with mixing ladle.

(ii) Epoxy mortar

The epoxy base and activator shall be mixed strictly in accordance with the manufacturer's instructions.

The epoxy and aggregate shall be weigh-batched. The base and activator shall first be mixed thoroughly for at least 180 seconds and until a consistent uniform colour is maintained, whereafter the aggregate shall be added and mixed to a uniform consistency. The manufacturer's instructions shall be strictly adhered to.

(iii) Proprietary cementitious repair compounds

The repair compound shall be mixed strictly in accordance with the manufacturer's specifications. Unless otherwise specified the product shall be thoroughly mixed in a forced-action mixer of adequate capacity. Alternatively a suitably sized drum may be used with a slow speed (400/500 rpm) high-torque rotary drill fitted with an approved mixing paddle. The contents shall be properly mixed to ensure a smooth, uniform mix.

The mixing capacity and placing capacity of equipment and labour shall be adequate and matched to enable placing operations to be carried out continuously within the recommended placement time of the product, generally within 20 minutes of mixing ensuring a smooth, uniform mix. The mixed product shall be passed through a suitable coarse metal screen prior to placing or pumping to remove any lumps of unmixed product. Tools and equipment shall be cleaned after each batch and all previously mixed material shall be removed from tools and equipment prior to charging and mixing a new batch of repair compound.

(e) Formwork for structural concrete repair

All formwork surfaces which will be in contact with proprietary concrete repair compounds shall be treated with a suitable mould release agent. The formwork surfaces shall match the existing surface textures as closely as possible.

The formwork shall be constructed to be leakproof with suitable provision for the drainage of pre-soaking water or access for the application of a surface bonding layer immediately prior to placing the repair concrete.

(f) Application of the repair material

(i) Cementitious mortar

After the defective concrete surface and the embedded reinforcement have been prepared, the bonding layer shall be worked onto the concrete contact surface followed directly by the freshly mixed repair mortar. The mortar application shall follow the technique of plastering.

The mortar surface shall be trowelled when the mortar exhibits initial set to obtain a uniform plain surface true to line, matching the boundaries of the repair area, and shall then be finished to match the adjacent existing surface finish.

Local areas, where deep recesses have been cut out, or where concrete has been removed around reinforcement bars, shall be built up in thin layers not exceeding 20mm over several work sessions.

(ii) Concrete

After the defective concrete surface or member has been prepared, an approved bonding layer shall be worked onto the concrete contact surface followed directly by the freshly mixed concrete. The concrete shall be properly compacted and where possible, vibrators shall be used.

(iii) Epoxy mortar

The epoxy mortar shall be applied in accordance with the manufacturer's recommendation and specification.

Each layer of epoxy mortar shall be trowelled onto the prepared and primed surface in one work session. The rate at which the epoxy mortar can be applied shall determine the batch quantity such that the pot life of the epoxy is not exceeded. Unused mortar for which the pot life has been exceeded shall be discarded.

(iv) Proprietary cementitious repair compound

The proprietary compound shall be applied in accordance with the manufacturer's recommendation and specification.

The minimum layer thickness shall be 10mm with a maximum as specified by the manufacturer, depending on the orientation of the application.

Each layer of repair compound shall be thoroughly worked and compacted into the repair zone ensuring that full contact with the primed contact surface is achieved and no air entrapment occurs. All sagging or slumping material shall be removed and the contact surface cleaned prior to re-application using a reduced layer thickness.

g) Protection and curing

(i) Cementitious mortar or concrete

The finished mortar surface shall be protected from drying out due to wind, direct sunlight or frost. The contractor shall arrange such protection to the engineer's approval who will assess each case on its merits.

The surfaces shall be cured over a period of at least 7 days by spraying a uniform, full coat of an approved resin-based curing membrane not later than 8 hours after placement of the mortar, but within 20 minutes after stripping the formwork, or by any other approved procedure.

(ii) Epoxy mortar

The mortar shall be protected from rain and frost for at least 24 hours and shall be cured in accordance with the epoxy supplier's recommendations, or as directed by the engineer.

(iii) Proprietary cementitious repair compounds

Immediately after the proprietary compound has been applied or after formwork has been removed cure the compound as per the manufacturer's detailed instructions.

h) Reinstatement of concrete cover

(i) Cementitious mortar

The mortar shall consist of one part cement and two parts sand (0-2mm) by mass with a water/cement ratio not exceeding 0,42. Additives approved by the engineer may be used to improve workability.

The mortar shall be applied to minimum thickness of 10mm and the finished surface shall be treated with an approved diffusion resistant coating. Such coating shall be applied in at least two coats of 150 to 250g/m².

(ii) Epoxy Mortar

Epoxy mortars shall not be applied to structural concrete surfaces with temperatures below +10°C.

The concrete and reinforcement shall be prepared as described in Clause 12 305(g) and primed with the bonding layer before applying the approved epoxy mortar based on the size and depth of repair.

(i) Partial removal of concrete to expose reinforcement

Where a structural element contains embedded reinforcement which will be reused in the rehabilitation process, the concrete shall be carefully chipped away without damaging the reinforcing bars. Damaged bars shall be replaced with new reinforcement of similar type and size, subject to the engineer's approval.

(j) Sounding survey

On instruction from the engineer a sounding survey shall be carried out by striking the concrete with a club hammer of approximately 1kg mass and recording the location of hollow sounding areas. On plane areas of concrete the surface shall be sounded at approximately 300mm centres in each direction. On columns, beams or other similar members with faces less than 300mm wide, each face shall be sounded near each edge or corner at approximately 300mm centres along the member. Where a hollow sounding area is detected its extent shall be determined by local sounding and its periphery marked on the surface of the member.

F12 306 TOLERANCES

The contractor shall apply the patching mortar or concrete and finish the surface to the line and level of the existing concrete and within the tolerances specified on the drawings, or if none is specified, to the tolerances specified in COLTO Standard Specification, Section 6800.

F12 307 TESTING

(a) Material

The contractor shall ensure that only compatible materials are used as ingredients for the repair mixes.

The contractor shall carry out pre-construction compatibility tests on the proposed repair system to ensure that the strength and serviceability requirements of the structural rehabilitation are met. The test results shall be reported to the engineer and shall be subject to the engineer's approval.

(b) Acceptance testing

F123.03 Proprietary cementitious repair compound (Repair systems) to (description)

litre
(ℓ)

The unit of measurement is the litre of proprietary repair compound used for the repair of specified concrete defects.

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to break out, prepare, prime all surfaces, repair and cure the designated areas (including for wastage) all in accordance with the project specifications and the repair material manufacture's procedures, methods and specifications.

| Item | Unit |
|--|------------------------|
| F123.04 Curing of repair surfaces | |
| (a)By coating the surface with (type indicated) to (description) | square metre |
| (b)Curing by (method indicated) to (description) | (m2) square metre (m2) |

The unit of measurement is the square metre of concrete repair surface treated or coated by the method and curing compound indicated and accepted by the engineer.

The tendered rates shall include full compensation for all labour, materials, plant, equipment and safety measures required to cure the repair work to the satisfaction of the engineer.

In addition the tendered rates shall make full provision for all efforts to remove existing concrete behind the reinforcement with inadequate cover, and to force the reinforcement deeper into the exiting member. The tendered rates shall cover all the cleaning and preparation of all surfaces in accordance with the supplier specifications, inclusive of the cleaning and treatment of existing reinforcement steel. The tendered rate shall include for curing as specified.

| Item | Unit | F123.05 Sounding survey | litre (ℓ) |
|-------------|-------------|--------------------------------|-----------|
|-------------|-------------|--------------------------------|-----------|

The unit of measurement for the sounding survey shall be the square metre of area tested.

The tendered rate shall include full compensation for everything that is necessary to carry out the survey as specified or instructed, mark out repair limits on the concrete surfaces and accompany the engineer during subsequent inspection to confirm the extent of concrete that is to be repaired on the basis of the sounding survey.

B14. SECTION 12 400: GROUTING AND CRACK INJECTION

F12 401 SCOPE

This specification covers the requirements for the filling of gaps, holes and pockets with fluid grout systems and the injection of cracks and cavities with low-viscosity liquid epoxy systems.

F12 402 INTERPRETATION

(a) Supporting Specification

The following specifications shall be read with and shall form part of the contract:

- (i) Project Specification
- (ii)COLTO Standard Specifications for Road and Bridge Works for State Road Authorities (1998 edition)

(b) Definitions

- (i) Grouting

Grouting means the filling of gaps between structural elements by using gravity techniques or to fill holes or pockets in concrete members including the embedment of dowels, anchors, steel sections, etc. Grouting is generally done with a proprietary high-strength, non-shrink, cementitious compound or epoxy system.

(ii) Crack injection

Crack injection means the filling of cracks and internal cavities in concrete members with low-viscosity liquid epoxy adhesive by a lowpressure injection procedure.

(iii) Epoxy adhesive

Epoxy adhesive means the compound that serves to bond together two separate materials or contact faces resisting the interfacial stresses to ensure structural composite action of the joined materials.

F12 403 MATERIALS

(a) **Grout**

(i) Cementitious grout

The materials for the grout shall be supplied as a factory pre-packed dry premix of Portland cement powder, graded fillers and other proprietary products requiring only the addition of water to produce the required consistency ranging from a plastic state to a freeflowing liquid grout. The proprietary grout shall compensate for shrinkage in both the plastic and hardened states whilst hardening free of bleeding and settlement, without gas-generating and air-releasing agents.

Free-flowing grouts shall be suitable for use by pumping and mix-and-pour placing techniques, and shall be highly workable, selfcompacting and self-levelling without the use of vibrators. The grout shall have a low alkali content to ensure minimal risk of alkalisilica reaction and shall contain no chlorides.

The proprietary grout shall comply with the material properties indicated on the detail drawings or by reference to a particular product.

Only material of which the shelf life has not expired shall be used.

All necessary health, safety and fire precautions according to the manufacturer's specifications shall be complied with.

(ii) Epoxy and polyester resin grout

The materials for the grout shall consist of a factory pre-packed, solventfree, two-part epoxy of polyester adhesive consisting of resin and hardener components and specially prepared and graded aggregate. The epoxy shall be low viscosity modified aliphatics or amidoamines with a high resistance to moisture and low creep values under sustained loads.

The mixed adhesive shall have a smooth, free-flowing liquid consistency which, when mixed with the aggregate, will not separate or settle out prior to curing.

The grout system shall be suited to the intended application and the toxicity of the chemicals in the components shall be low enough to enable safe usage in confined areas of the construction site and in a normal workshop environment.

All necessary health, safety and fire precautions according to the manufacturer's specifications shall be complied with.

(iii) Working characteristics of grout

- Application

The grout system shall be suitable for application by pouring into gaps, holes or pockets depending on the particular circumstances.

- Cure time and temperature

The grout shall be capable of curing to the required strength at ambient temperatures between 10°C and 40°C in relative humidities up to 95%.

The grout must cure sufficiently within 24 hours, to the compressive strength specified on the drawings, with negligible shrinkage on curing.

(b) Crack injection

(i) Adhesive

The adhesive used for epoxy injection into cracks in concrete shall consist of an unfilled, solvent-free, two-part epoxy consisting of resin and hardener components. The epoxy shall be low viscosity modified aliphatics or amidoamines with a high resistance to moisture and low creep values under sustained loads.

The adhesive components shall be supplied in liquid form and in separate sealed containers. Each component shall have a different identifiable colour which results in a distinctive homogeneous colour when thoroughly mixed.

The adhesive shall mix readily to a smooth liquid consistency of low to medium viscosity and shall be suitable for injection into cracks on surfaces ranging from horizontal to vertical and on inverted overhead surfaces.

The mixed adhesive shall be free of lumps and the components shall not separate or settle out during the pot life of the adhesive.

The toxicity of the chemicals in the components shall be low enough to enable safe usage in confined areas on the construction site and in a normal workshop environment. If special ventilation is necessary such requirement shall be complied with.

(ii) Working characteristics of adhesive

- Application

The adhesive shall be suitable for injection into cracks and voids under low pressure.

The viscosity of the epoxy shall be matched to the crack width and material macroporosity surrounding the crack, generally between 200 cP and 400 cP at 25°C.

The adhesive shall be capable of bonding to dry and moist surfaces where the injected adhesive displaces moisture present in cracks and cavities.

- Pot life

The usable life (pot life) of the mixed adhesive shall exceed 60 minutes at 25°C and a relatively high humidity, unless special circumstances dictate a fast-setting adhesive.

- Storage life

The storage life (shelf life) in the original sealed containers of both the resin and hardener shall not be less than 6 months stored at temperatures between 5°C and 25°C. Only batches of material of which the shelf life has not expired shall be used.

- Cure time and temperature

The adhesive shall be capable of curing to the required strength at temperatures between 10°C and 40°C in relative humidities of up to 95%.

The adhesive must cure sufficiently to confer the specified mechanical properties within 7 days, with negligible shrinkage on curing.

(iii) Mechanical properties of cured adhesive

- Moisture resistance

The adhesive shall be formulated to minimise moisture transport through the adhesive itself. Water absorption shall not exceed 2% by mass after immersion for 24 hours in distilled water at 20°C.

- Temperature resistance

The adhesive shall have a heat distortion temperature (HDT) of at least 50°C.

- Flexural modulus

The instantaneous flexural modulus of the adhesive shall be between 2,0 GPa and 10,0 GPa at 20°C. The adhesive must have a consistent static fatigue behaviour for temperatures ranging between -20°C to 40°C.

- Shear strength

The bulk shear strength of the adhesive shall exceed 12 MPa at 20°C.

- Tensile strength

The tensile strength of the adhesive must exceed 12 MPa at 20°C.

- Double lap shear strength

The average lap shear strength of a double overlap joint at failure using steel plates shall exceed 8 MPa at 20°C.

- Epoxy resin injection

The crack repair system shall be either:

| | |
|--|--|
| <p>A. Repair System 1*</p> <p>External crack sealing</p> <p>Filling in injection ports</p> <p>Grouting up cracks</p> | <p><i>Sika Products</i></p> <p><i>Sikadur 31</i></p> <p><i>Sikadur 31</i></p> <p><i>Sikadur 52</i></p> |
| <p>B. Repair System 2*</p> <p>External crack sealing</p> <p>Filling in injection ports</p> <p>Grouting up cracks</p> | <p>Pro-Struct Products</p> <p>Pro-Struct 617NS</p> <p>Pro-Struct 617NS</p> <p>Pro-Struct 618LV</p> |
| <p>C. Repair System 3</p> | <p>Alternative as proposed by the contractor.</p> <p>The contractor shall submit details of Repair System 3 to the engineer for approval during the tender period.</p> |

**(Note to compiler: Repair systems to be discussed with the Agency first before incorporating into document)*

(c) Quality control

The material manufacturer's quality control and conformance certificates and test results for each batch of material supplied to site shall be made available to the engineer upon request.

The average test results shall meet the specification requirements and no single result shall deviate by more than 15% from the specified criteria.

(d) Packaging, handling and storage

All adhesive components shall be supplied in separate sealed containers of suitable sizes to obtain a workable quantity within the potlife of the adhesive. The components shall be packaged in the correct portions so that the entire contents of each container mixed together shall produce a mix of the correct proportions. The adhesive properties shall not vary significantly with minor variations in the mix proportions resulting from the container emptying process.

Each container shall be durably and legibly marked and complete records of stock acquired and issued for use, shall be kept. The containers shall be clearly marked with the following information:

- name of manufacturer;
- manufacturer's product identification;
- batch number and date of manufacture;
- date of expiry of shelf life;
- manufacturer's instructions for mixing; and
- safety precautions, warnings for handling and toxicity.

(e) Manufacture's instructions

The manufacturer shall provide a dated, coded and titled instruction sheet with each delivery of adhesive. The following information shall be contained on the sheet in a clear and unambiguous manner:

- i) the general chemical type of each component used in the adhesive;
- ii) recommended storage conditions and shelf life when stored under these conditions; iii) preparation instructions for steel and concrete surfaces;
- iv) instructions for use of primers, including optimum dry film thickness and permissible ranges;
- v) mixing instructions, including allowable variations in mix ratio and any temperature control requirements during the mixing process; vi) application instructions, including limits on pressure, temperature, open time and relative humidity before injection; vii) safety precautions for all components of the adhesive; and viii) curing conditions and temperature-related precautions.

(f) Surface sealant for cracks

The surface sealant for cracks and for the bonding of injection ports to the concrete surface shall be an approved epoxy putty.

(g) Injection ports

Injection ports shall consist of short lengths (75mm to 100mm) of small diameter (3mm to 5mm ID), flexible, high-pressure plastic tubing each fitted with a locating end at the base for bonding in the crack sealant. The locating pin shall be supplied with a length of wire flattened at the end for accurate positioning of the tube over a crack.

Grease nipples or similar self-closing injection nipples shall not be used unless authorized by the engineer. Sufficient field testing to demonstrate the satisfactory operation of such injection port shall precede any approval application.

F12 404 PLANT AND EQUIPMENT

(a) General

All plant and equipment used for pressure injection of epoxy resins shall be based on proven technology and practice, and shall be maintained in a clean and good working order. The equipment shall be inspected, serviced and calibrated at regular intervals and tested to ensure that the system functions efficiently and accurately, such procedures being to the satisfaction of the engineer.

(b) Pressure injection equipment

The type and capacity of the pressure injection equipment, delivery hoses and nozzles shall be such as to ensure the uniform supply of separate components to the mixing nozzle, thereby obtaining the correct consistency and a uniform discharge rate from the nozzle.

The pressure injection equipment shall be capable of continuously supplying the freshly mixed epoxy resin on demand. The equipment shall be fitted with properly calibrated positive displacement pumps and a pressure gauge capable of recording correct pressures applied up to 2,0 MPa with 0,1 MPa divisions.

The two components of the epoxy injection compound shall be fed separately to the extrusion gun and shall only be mixed together within the pressure chamber of the gun at the time of injection. On no account shall ready-mixed epoxy be fed to the extrusion gun.

(c) Temporary access structures and working platforms

Where necessary the contractor shall provide specialist additional safe temporary access structures and working platforms at each location for grouting or crack preparation and injection procedures. Provision for general access and work platforms shall be in accordance with Section 12 100.

The temporary structures and platforms must be stable and of sufficient strength and rigidity to safely carry all imposed temporary loads arising from the work activity.

F12 405 CONSTRUCTION

(a) Grouting

(i) Preparation of contact surfaces

Concrete contact surfaces shall be prepared by removing all surface laitance and damaged, loose and soft concrete, concrete containing aggressive ions, e.g. chloride, as well as cleaning the surfaces of all foreign adherents and impregnants such as oil, paint, grease, curing compounds, dirt, etc. The contact surface shall be treated to expose the sound substrate by means of chiselling, grit blasting or high-pressure water-jetting.

The mechanically prepared surfaces shall be finally cleaned of loose dirt and dust by means of oil-free compressed air, water-jetting or vacuum cleaning, as appropriate.

(ii) Holes and pockets for embedding dowels, anchorages etc.

Pockets that are formed in concrete must be cleaned of all foreign material and prepared as for the contact surfaces in clause 12 405(a)(i) above. Holes shall be drilled using approved mechanical equipment. The size of a drilled hole is dependant on the type of grout to be used, and as a guideline the following sizes are recommended as a minimum, based on the dowel or anchor bar diameter, D.

Dimensions of drill holes

TABLE 1

| Grout type | Diameter of hole | Minimum depth of hole | Direction and Inclination |
|--------------|------------------|-----------------------|---------------------------|
| Cementitious | 1,5 to 2,0.D | 15.D | As detailed on drawings |
| Epoxy resin | 1,3 to 1,5.D | 15.D | |

The diameter, depth, direction and inclination of the holes required shall be as shown on the detail drawings, but shall not be less than the dimensions scheduled in Table 1. Before the holes are grouted, the dowel bars, anchors, etc shall be cleaned, and all water, concrete and residue and other foreign material shall be blown out of the hole with compressed air.

(iii) Pre-soaking

The use of a cementitious compound requires the pre-soaking of the concrete substrate with water several hours prior to grouting. All free water shall however be removed from the surface and holes or pockets immediately prior to grouting.

The use of an epoxy or polyester resin grout usually requires a clean and substantially dry contact surface. No pre-soaking is required unless specified by the grout manufacturer.

(iv) Formwork

Temporary formwork to place and contain the fluid grout may be required. Reference shall be made to the manufacturer's recommendations regarding flow distance based on the gap width and the fluid head at the pouring side. The unrestrained or exposed surface area of the grout shall not extend more than 50mm beyond the perimeter of the smaller contact surface. The formwork shall be constructed to be leakproof to prevent wastage and loss of material.

(v) Batching and mixing

The proprietary grout shall be batched and mixed strictly in accordance with the manufacturer's instructions and specifications.

Unless otherwise specified, the product shall be mixed thoroughly in a forced action mixer of adequate capacity. Alternatively a suitably sized container equipped with a slow-speed (400/500 rpm), high-torque rotary drill fitted with an approved paddle may be used. The liquid components shall be properly mixed to ensure a smooth uniform mix prior to adding the aggregate.

The premixed aggregate shall be added slowly to the liquid binder and mixed until an evenly coated and wet mix is obtained.

The mixing and placing capacity of equipment and labour shall be adequate and matched to enable placing operations to be carried out continuously within the recommended pot life or placement time of the product, generally within 15 minutes of mixing for cementitious grouts. The mixed product shall be passed through a suitable coarse metal screen prior to placing or pumping to remove any lumps of unmixed product.

The mixed product shall not be used after expiry of the pot life and all material unused after the placement time limit, shall be discarded. All previously mixed material shall be removed from tools and equipment prior to charging and mixing a new batch of grout.

(vi) Placement of grout for bedding or gap filling

The mixed grout shall be placed within the placement life or pot life of the material in accordance with the manufacturer's instructions regarding specific placement recommendations and procedures.

In general, continuous grout flow is essential, hence sufficient mixed grout shall be available prior to commencing placement, and the rate of placing a batch shall be matched to the time taken to batch and mix a new batch.

Placement shall take place at one end of a gap to ensure continuous flow through the gap expelling all air from the exit opening. A sufficient grout head shall be maintained at the inlet end to ensure a continuous grout front through the gap.

For an epoxy grout a single batch shall not exceed 30l of mixed material.

For large batches of cementitious grout, placing by pump may be considered.

(vii) Grouting of dowel bars and anchors into holes and pockets

The grout type and consistency used shall be suited to the application and adequate measures shall be taken to prevent grout loss from the hole or pocket during the setting period. If necessary, a thixotropic grout shall be used.

The hole or pocket shall be filled with the prepared grout making allowance for the displacement of material by the item to be embedded.

Immediately after the hole has been filled with grout to the determined level, the embedment object shall be inserted slowly into the hole with a rotary motion so as to displace the grout without incurring over-displacement, which may leave the hole not full, and ensuring complete wetting of the object and the concrete faces.

Precautions shall be taken to ensure that the hole is completely filled and no air is entrapped.

The embedded object shall not be disturbed until the bond is effective, and the necessary support shall be provided to hold the object firmly in position until the grout has gained sufficient strength.

(viii) Protection and curing

The exposed grout surfaces which are not cut back shall be protected from wind, rain and high temperature which can cause rapid drying out in cementitious grouts.

Cementitious grouts shall be thoroughly cured by means of an approved curing compound and procedure suitable for the product.

(b) Crack Injection

All work related to the injection of cracks with epoxy shall be executed in accordance with the approved method statement as confirmed by site tests according to clause 12 406(a).

(i) Extent and sequence of work

The extent of work will be indicated by the engineer and no work may commence unless instructed by the engineer. The extent of the actual work may vary very significantly from that indicated in the pricing schedule and the contractor is advised to discuss the extent of the work with the engineer at the outset of the contract before establishing the necessary personnel, equipment or plant on site.

Following the erection of the necessary temporary access and working platforms at the work location, the engineer, assisted by the contractor, shall undertake a detailed inspection of the existing concrete surfaces to identify cracks requiring epoxy injection. The engineer shall then issue an instruction to the contractor detailing the extent and nature of the work. In general, only cracks exhibiting a surface crack width exceeding 0,2mm shall be injected unless instructed to the contrary.

(ii) Crack preparation

All surfaces within 50mm of a crack line shall be thoroughly cleaned of all foreign material likely to impair the bond of the surface sealant to the concrete by high-pressure water-jetting, wet grit blasting or other approved mechanical means. All loose spalls and foreign materials within the crack shall be similarly removed followed by final cleaning with clean, oil-free compressed air. The concrete surface and crack shall be allowed to dry out completely and finally cleaned before commencing with crack sealing and injection.

(iii) Surface sealing and injection port installation

The whole surface of the crack shall be temporarily sealed with a sag resistant fast setting epoxy surface sealant cured with a modified aliphatic amine. The type of temporary sealant used shall be such that it can be removed without causing damage to or defacement of the concrete surface. Approved injection ports shall be properly spaced along cracks, but shall not be drilled and fixed directly into the crack. The injection ports shall be located over the cracks using the locating wire and the locating end shall be firmly sealed and bonded to the concrete surface with a generous amount of epoxy sealant. Thereafter the crack surface between injection ports shall be sealed with an approved epoxy surface sealant band at least 3mm thick and 30mm wide.

While guidelines can be given for proper spacing, good judgement must be the final criterion.

Guidelines for injection port spacing in partial depth cracks are as follows:

- Spacing between injection ports should be equal to the desired depth of penetration since the resin generally travels as far into the crack as along the face of the crack. If port-to-port travel at this spacing is not obtained, intermediate injection ports must be established.
- If the cracks are less than 0,20mm wide, injection ports should not be spaced more than 150mm apart.
- If the cracks are more than 0,6mm in depth, full penetration may be difficult to achieve because of equipment limitations. Intermediate ports should be established to monitor the flow of epoxy.

Guidelines for injection port spacing in cracks extending the full depth of the member are as follows:

- Members up to 0,3m thick

For members 0,3m or less in thickness, injection ports should be placed in the crack on one side only and spaced at the thickness of the member.

- Members 0,3m to 0,6m thick

For members 0,3m to 0,6m in thickness, injection ports should be placed in the crack on all available sides and spaced no more than the thickness of the member.

- Members over 0,6m thick

For members greater than 0,6m in thickness, injection ports should be placed in the crack on all available sides and spaced according to the guidelines set forth for the partial depth cracks.

The first and last injection ports must be established at either end of a crack in a member.

(iv) Epoxy resin injection

Either the pressure injection or vacuum impregnation technique of crack injection shall be used.

The epoxy surface sealant shall have cured fully before commencing with any crack injection.

All traces of cleaning solvent and air shall be expelled from the injection gun prior to commencing with crack injection.

Using an automatic epoxy mixing gun, the epoxy resin shall be injected in such a way that there is a steady displacement of air and moisture from within the crack. Starting from the lowest injection port at one end, the epoxy resin shall be injected until resin flows out of the next injection port. The upper injection port is closed and the process of injecting the epoxy resin is continued briefly. A steady injection pressure shall be maintained, however at no stage shall the pressure exceed 1,0MPa.

The gun shall then be moved to the injection port where the resin has flowed out and the procedure is repeated for the length of the crack. After the crack is filled, and not longer than 30 minutes after the work has begun, another attempt shall be made to inject more resin, starting at the first port.

Before injection work starts, a rough calculation shall have been made as to the amount of resin required to fill the crack. If consumption exceeds the estimated quantity by more than three times, the matter shall be referred back to the engineer for investigation. At all cracks, contact surface or repaired cavities, epoxy injection shall commence at the lowest injection point and at one end, and shall in all cases be executed such that there is a steady displacement of air, residual moisture and fine material from the void being injected.

During the entire injection operation, the sealing lines (on both sides in the case of full depth cracks) and adjacent concrete surfaces shall be inspected for any signs of leakage of epoxy and, if observed, the injection shall be stopped and the leaking region sealed or resealed.

Further injection shall recommence only once the epoxy sealant repair has cured sufficiently. Accurate and complete records shall be kept of the amount of epoxy injected into each crack, contact surface or repaired cavity together with any leakage that may have occurred during the injection operation.

After satisfactory completion of the pressure injection at any particular location and the full curing period of the epoxy injection material, the injection points and all epoxy sealant shall be removed and the concrete surfaces and crack lines, as applicable, made good, grinding down the areas as necessary and finished to a smooth and clean surface.

Where the crack is chased out, the chase should be filled with an approved repair material and finished flush with the concrete surface.

(c) Crack filling

(i) Extent and sequence of work

The extent of the work will be indicated by the engineer and no work may commence unless instructed by the engineer. The extent of the actual work may vary very significantly from that indicated in the pricing schedule and the contractor is advised to discuss the extent of the work with the engineer at the outset of the contract before establishing the necessary personnel, equipment or plant on site.

Following the erection of the necessary temporary access and working platforms at the work location, the engineer, assisted by the contractor shall undertake a detailed inspection of the existing concrete surfaces to identify cracks requiring filling. The engineer shall then issue an instruction to the contractor detailing the extent and nature of the work. In general, only cracks exhibiting a surface crack width exceeding 0,2mm shall be filled unless instructed to the contrary.

(ii) Surface preparation

All surfaces within 50mm of a crack line shall be thoroughly cleaned of all foreign material likely to impair the bond of the surface sealant to the concrete by high pressure water jetting, wet grit blasting or other approved mechanical means. All loose spalls and foreign materials within the crack shall be similarly removed followed by final cleaning with clean, oil free compressed air. The concrete surface and crack shall be allowed to dry out completely and finally cleaned before commencing with crack filling.

(iii) Crack preparation

Create a vee notch in the concrete approximately 20mm wide over the crack using a hammer and chisel or small power tools. Clear all debris, loose concrete and dust and prime the surface with the specialised materials.

(iv) Crack filling

Fill the vee notch with specified material and grind smooth with the surrounding surface when cured.

The repair system shall be either:

| | |
|--|--|
| <p>A. Repair System 1</p> <p>Priming concrete surfaces</p> <p>Concrete repairs</p> <p>Curing repairs</p> | <p><i>Sika Products</i></p> <p><i>Sika Top-Armatec 110</i></p> <p><i>Sika Mono Top 615HB</i></p> <p><i>Antisol 15</i></p> |
| <p>B. Repair System 2</p> <p>Priming concrete surfaces</p> <p>Concrete repairs</p> <p>Curing repairs</p> | <p><i>Degussa Products</i></p> <p><i>Concresive ZR</i></p> <p><i>Ermaco S88 CT</i></p> <p><i>Master cure 107</i></p> |
| <p>C. Repair System 3</p> <p>Priming concrete surfaces</p> <p>Concrete repairs</p> <p>Curing repairs</p> | <p><i>Pro-Struct Products</i></p> <p><i>Saturate with portable water</i></p> <p><i>Pro-Struct 528 VO</i></p> <p><i>Water ½ hour after initial set</i></p> |
| <p>D. Repair System 4</p> | <p><i>Alternative as proposed by the contractor.</i></p> <p><i>The contractor shall submit details of Repair System 4 to the engineer for approval during the tender period.</i></p> |

**Note to compiler: Repair systems to be discussed with the Agency first before incorporating into document*

F12 406 TESTING

(a) Site tests

The contractor shall ensure that only approved materials for the proposed crack injection process are used. Preconstruction site tests to confirm proposed work procedures shall be undertaken in accordance with this specification and the approved preliminary method statement. Any variation to procedures or material usage arising from site test results shall be incorporated into the approved final method statement. Further site tests to confirm revised procedures or material use, and test coring to confirm crack penetration and sealing quality shall be at the discretion of the engineer.

(b) Core tests

Test coring from the actual crack injection areas shall be done at positions and at intervals as instructed by the engineer to confirm satisfactory crack penetration and sealing quality. The core size shall be 25mm to 50mm nominal diameter and shall extend at least to the full depth of the crack or other dimension as instructed.

Acceptance of the core results will be at the discretion of the engineer. Site tests and core tests as required by the engineer will be reimbursed under the relevant payment items.

F12 407 MEASUREMENT AND PAYMENT

Payment for items in this section shall include full compensation for all work associated with grouting and crack injection of concrete structures which are not already covered by the measurement and payment items of the COLTO Standard Specification or the Project Specification such as procurement, transport, additional access and temporary works and plant and equipment required to undertake the work as specified. General access, work platforms and associated temporary works shall be measured in Section 12 100.

The quantities indicated in the pricing schedule Section 12 400 are based on inspections performed as part of the preliminary and detail design phases increased to allow for defects that were not identified. The actual work done may vary significantly from the scheduled quantities and the contractor shall be deemed to have allowed in his tendered rates for such variations as can be reasonably expected.

| Item | Unit |
|---|-------------|
| F124.01 Preparation of contact surfaces for grouting (type, position and size indicated) | number (No) |

The unit of measurement shall be the number of surfaces of type, position and size that have been prepared for grouting.

The tendered rate shall include full compensation for all labour, materials, plant and equipment as well as all work and incidentals required to adequately prepare the concrete surfaces, including any pre-soaking where required.

| Item | Unit |
|---|-------------|
| F124.02 Grouting for: | |
| (a) Bedding (type, thickness and size indicated) to (description) | litre (ℓ) |
| (b) Gap filling (type, thickness and size indicated) to (description) | litre (ℓ) |

The unit of measurement shall be the volume of grout used measured in situ according to the sizes indicated on the drawings.

The tendered rate shall include full compensation for all labour, material, plant and equipment as well as all work and incidentals required to supply, mix, place and cure the grout in position including any temporary formwork, support and control measures as necessary to assist the placement procedure.

| Item | Unit |
|---|-------------|
| F124.03 Grouting of dowel bars and anchors into: | |
| (a)holes (hole, diameter and depth stated) in (description of member) | number |
| (b)pockets (pocket size and depth stated) in (description of member) | (No) |

number
(No)

The unit of measurement shall be the number of dowel bars or anchors installed into holes or pockets as specified.

The tendered rate shall include full compensation for all labour, material, plant and equipment as well as for all work and incidentals required to install each item as detailed on the drawings including all drilling and cleaning of holes, preparation of pockets, supplying, placing and curing of grout and the installation, support and treatment of each item as indicated.

| Item | Unit |
|--|-------------|
| F124.04 Establishment on site for crack injection | lump sum |

The unit of measurement shall be the lump sum.

The tendered sum shall include full compensation for the establishment on site and the subsequent removal of all special plant and equipment required for the pressure injection of epoxy resin into cracks and any additional plant, specialist access structures and work platforms required for the execution of the work.

The lump sum shall be paid as follows:

- (i) 75% when all equipment is established on site and the first crack injection work has been satisfactorily completed according to the approved method statement,
- (ii) 25% after all crack injection work has been satisfactorily completed and the equipment is removed from site.

| Item | Unit |
|---|--------------|
| F124.05 Crack injection with epoxy resin to (location) | metre (m) |

The unit of measurement shall be the metre (m)

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to prepare, prime all surfaces, repair and cure the designated cracks (including for wastage) all in accordance with the project specification and the repair material manufacturer's procedures, methods and specifications.

Item Unit F124.06 Site and core tests

- (a) Drilling of cores (specify diameter of cores) metre (m)
- (b) Site testing and testing of cores provisional sum percent
- (c) Percentage on provisional sum for charges and profit (%)

The unit of measurement for drilling of cores shall be the metre length of cores drilled and extracted. The tendered rate shall include full compensation for all labour, plant, equipment and material as necessary to drill and extract the cores, submit the cores to the engineer and to fill and finish the drilled holes to the approval of the engineer.

The stated provisional sum for site and core testing shall be employed to cover the cost of specific tests to be carried out as ordered by the engineer.

| Item | Unit |
|--|--------------|
| F124.07 Crack filling (Repair system to location) | metre (m) |

The unit of measurement shall be the metre (m).

The tendered rate shall include full compensation for all labour, materials, equipment and plant as well as for all work and incidentals required to, prepare, prime all surfaces, repair and cure the designated cracks (including for wastage) all in accordance with the project specification and the repair material manufacturer's procedures, methods and specifications.

B15. SECTION F12600: PROTECTIVE COATINGS AND TREATMENTS FOR CONCRETE

F12601 SCOPE

This section covers the material, equipment and work required for applying protective coatings and treatments to concrete surfaces.

F12602 INTERPRETATION

a) Supporting Specification

The following specifications shall be read with and shall form part of the contract:

- i) Project Specification ii) COLTO Standard
Specifications for Road and Bridge Works (1998).

F12603 MATERIALS

a) Penetrant pore liner (Water-repellant surface impregnants)

Penetrant pore liners are low viscosity fluids which penetrate the concrete surface. After the concrete has been impregnated by one of these substances, the carrier fluid evaporates, leaving behind a hydrophobic (water-repellant) layer in the pores of the concrete.

They are generally colourless and make little change to the appearance of the concrete.

Typical examples are silanes, siloxanes, silicon resins and stearates.

b) Penetrant pore blocker

Penetrant pore blockers are low viscosity solutions that can penetrate concrete surfaces and block the pores, thereby increasing the surface density of the concrete.

Some of these materials react with the concrete substrate (calcium hydroxide present in hydrated cement) to form crystals. Other fluids such as resins and drying oils, penetrate and harden by chemical reaction.

Typical examples are silicates, silicon fluorides, epoxy resins and acrylics.

c) Sealer

Sealers are more viscous fluids which both penetrate the concrete and form a thin film on its surface. They are sometimes used as sealing coats or primers to a coating. The thin film of the sealer is vulnerable to weathering.

Typical examples are epoxy resins, polyurethanes, acrylics and linseed oil.

d) Coatings

Coatings are viscous fluids that form a film on the surface of the concrete and provide protection as a result of the thickness of the film itself. They are usually pigmented to provide colour, and extended or filled to provide thickness and surface texture to the coat.

Typical examples are epoxy resins, polyurethanes, alkyds, vnyils, acrylics, chlorinated rubber, styrene-butadyne, bitumens and combinations of these.

e) Renderings

Renderings are thick film coatings, generally applied by trowel rather than by brush or spray. They work in a similar way as coatings, by providing a physical barrier.

Typical examples are cement mortar with various polymer additions and crystal growth systems.

f) Carbonation inhibitor barrier coatings

An approved carbonation inhibitor barrier coating shall comply with the following criteria:

- i. Present a uniform appearance with the final colour to be decided by the engineer
- ii. Provide barrier protection against ingress of water, oxygen and carbon dioxide
- iii. Permit the passage of water vapour
- iv. Resist the deleterious effects of UV light
- v. Weather such that only minimal surface preparation is required when overcoating
- vi. Adhere strongly to concrete and repair materials
- vii. Structure minor cracks and have flexibility to accommodate small movement
- viii. Provide a 12 year guarantee against coating failure and UV degradation
- ix. Supply a specification for surface preparation and application of over coating after a 12 year period

The coating material will be deemed to meet the requirements of (b) and (c) with respect to water, oxygen, water vapour and carbon dioxide barrier protection if it complies with the following specification:

- The product of the minimum dry film thickness of the coating (microns) and the carbon dioxide diffusion resistance coefficient shall exceed 50m
- The cured coating shall reduce the water absorption of good quality 30MPa concrete by a factor of at least 20
- The product of the average dry film thickness of the coating (microns) and the water vapour diffusion resistance coefficient shall not exceed 4m

In the event that a multi layer and / or a multi product system is proposed criteria (i) (ii) and (iii) shall apply to the complete system acting as a combined barrier coating.

g) Corrosion Inhibitor

Corrosion inhibitors are water based impregnating fluids that are applied to the outer surface of existing concrete members. Inhibitors migrate into concrete and are absorbed onto the surface of embedded reinforcing steel thus delaying the onset of corrosion and/or reducing the rate of corrosion that is in progress.

F12604 PLANT AND EQUIPMENT

a) General

All plant and equipment used for pressure cleaning and protective treatment application shall be based on proven technology and practice, and shall be maintained in a clean and good working order. The equipment shall be inspected, serviced and calibrated at regular intervals and tested to ensure that the system functions efficiently and accurately, all to the satisfaction of the engineer.

b) High-pressure water-jetting equipment

The type and capacity of the water-jetting equipment, delivery hoses and nozzles shall be capable of delivering at least 1000 kPa water pressure through nozzles which shall at least remove curing compounds or membranes and shutter release compounds without producing an exposed aggregate finish.

c) Low-pressure airless sprayer

Low-pressure airless sprayers consist of knapsack sprayers which shall be capable of providing a uniform discharge rate and even spread over the spray area.

d) Access structures and working platforms

Where necessary the contractor shall provide suitable and safe measures at each location for pressure cleaning and surface coating.

These provisions shall be deemed to form part of the access for bridge/structure rehabilitation as specified in Section 12 100

F12605 CONSTRUCTION

a) Storing of materials

The contractor shall provide a lock-up store for the repair materials and observe all storage requirements and safety precautions recommended by the materials manufacturers.

b) Surface preparation

i) Procedures

All concrete surfaces that are to receive protective coatings and / or treatments such as:

- Penetrant pore liners
- Penetrant pore blockers
- Sealers
- Coatings
- Renderings
- Corrosion inhibitors

Shall be prepared strictly in accordance with the materials manufactures instructions. The preparation shall include for everything that is necessary to prepare the surface to receive the protective coatings and / or treatments.

The contractor shall ensure that technical representatives, appointed or employed by the materials suppliers, carry out regular inspections of the preparation work and provide written confirmation that the work is in accordance with the materials suppliers requirements. The reports shall be specific and definitive, generalised statements will not be acceptable.

Where surface preparation is found by the technical representatives to be inadequate the report shall contain specific advice to enable the contractor to attain a required standard.

The contractor shall provide the engineer with copies of all technical inspection reports before any surface treatment or protective coatings is applied to a structural element.

Where the time between surface preparation and treatment exceeds two days and / or during windy and / or wet weather the prepared surfaces shall be reinspected and approved by the technical representative.

The moisture content of patch repair areas must be specifically checked by the technical representative to ensure that coatings are not applied over surfaces that contain moisture.

c) Batching and mixing

Mixing equipment, mixing times, working life and overcoating times shall conform to the manufacturer's recommendations taking into account the temperature at time of application.

Treatment materials shall be mixed (if applicable) and applied strictly in accordance with the manufacturer's specifications. Thinning or diluting shall not be permitted without the approval of the engineer.

d) Protective surface treatment

Surface treatment or coatings may consist of a system of several coats of more than one type of coating. Where such a system is applied, the various components shall be compatible and preferably from one manufacturer.

Protective treatments shall be applied to all of the exposed concrete surface as indicated. Items or areas which are not to be coated, shall be suitably protected or masked before application of the treatment.

i) Application of surface coatings

All protective coatings and treatments for concrete shall be stored, mixed and applied strictly in accordance with the product manufacturer's specifications and the project specifications.

All surface coating materials shall be handled, mixed and applied strictly in accordance with the manufacturer's specification..

ii) Application rate records

Records of application rates shall be submitted by the contractor to the engineer on a daily basis indicating batch numbers, the area covered by each coat and the quantity of coating material used. Only material from the same batch shall be used for any continuous, visible, unbroken surface to attain uniformity of colour and texture on the concrete surface.

iii) Trial sample panels

Protective treatment shall not be applied until trial sample panels of the protective treatment have been prepared by the contractor and approved by the engineer and the material suppliers technical representative.

The contractor shall prepare the sample panels using the same surface preparation mixing and batching equipment, application technique, application rate and under the same climatic conditions he intends to treat the whole structure. The position of the trial sample panels are subject to the engineer's approval.

Product manufacturers of coating products are required to inspect, assist and finally approve (in writing) all aspects of surface preparation and product application employed on the trial sample panel.

The trial sample shall be used as a standard against which the rest of the work will be judged and shall be maintained intact until all other coating work is complete.

iv) Proprietary protective surface coatings

The suitability of the protective surface coating for a particular application shall be proved by testing and submission of an approved industry track record of usage under similar circumstances.

The contractor shall submit details of proprietary protective surface coatings to the engineer for approval prior to its use in the permanent works.

The surface coating systems shall be either:

| | |
|--|---|
| <p>A. <u>Coating system 1</u> Corrosion inhibitor Penetrant pore liner</p> | <p><u>Sika Products</u> Sika Ferro Gard 903 Sikagard 705L</p> |
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| B. | <u>Coating system 2</u> Corrosion inhibitor Penetrant Pore Liner Barrier Coating | <u>Degussa Products</u> Protectosil CIT Dynasytan BHN Masterseal 300H (incl. primer) |
| C. | <u>Coating system 3</u> Penetrant pore liner Barrier coating | <u>Pro-Struct Products</u> Corrosion Inhibitor Cortec MCI 2020 Pro-Struct 670 Pro-Struct 684/4 |
| D. | <u>Coating system 4.</u> | Alternative as proposed by the Contractor. The contractor shall Submit details of Repair System 3 to the engineer for approval during the tender period. |

c) Health and Safety precautions

The contractor shall observe the health and safety precautions recommended by the manufacturer regarding the handling and the disposal of unused material and containers.

The contractor shall ensure that natural water streams or rivers are not polluted by protective treatment material under any circumstances.

F12606 TESTING

The contractor shall ensure that only compatible materials are used for the surface treatment or protective coatings.

The test results shall be reported to the engineer and will be subject to the engineer's approval.

F12607 MEASUREMENT AND PAYMENT

Payment for items in this section shall include full compensation for all works associated with the execution of the work and quality assurance procedures which are not separately covered by the measurement and payment items of the Standard Specifications or the Project Specifications. General access and work platforms and associated temporary works are covered in Section 12 100.

All work and material for which no specific pay item is defined shall be deemed to be covered by the items in this section.

| Item | Unit |
|--|-----------------------------------|
| 126.01 Cleaning and preparation of concrete surface (Method and surface finish indicated) | square metre (m ²) |

This item covers concrete areas that will not be treated with protective coatings and treatments.

The unit of measurement shall be the square metre of surface area cleaned by the method indicated.

The tendered rate shall include full compensation for all material, plant and equipment, all labour and incidentals required to execute the work as specified.

| Item | Unit |
|--|-----------------------------------|
| 126.02 Application of protective treatment and treatments (Type and application rate indicated) | square metre (m ²) |

(a) Supporting Specification

The following specifications shall be read with and form part of the contract:

- (i) Project Specification
- (ii) COLTO Standard Specification for Road and Bridge Works for State Road Authorities (1998 edition).

(b) Definitions**(i) Adhesive**

An adhesive serves to bond together two separate materials, and resists the interfacial stresses necessary to ensure structural composite action between the two materials.

(ii) Cold-cure adhesive

A cold-cure adhesive is capable of curing to the required strength between the temperatures of 10°C and 30°C.

(iii) Adherents

Adherents mean the parts, steel and/or concrete, to be joined by the adhesive.

F12 703 MATERIALS**(a) Adhesive**

The adhesive shall be a cured epoxy resin complying with the ASTM C-881-90, "Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete". The adhesive used for structural bonding of steel to concrete shall be a solventfree, two-part epoxy consisting of resin and hardener components. The epoxy shall be amide-based with a high resistance to moisture, and low creep values under sustained loads.

The adhesive components shall be supplied in liquid form and in separate sealed containers. Each component shall have a different identifiable colour, which results in a distinctive homogenous colour when thoroughly mixed.

The adhesive shall mix readily to a smooth paste-like (thixotropic) consistency and it shall be suitable for spreading on surfaces ranging from horizontal to vertical and on inverted overhead surfaces.

The mixed adhesive shall be free of lumps and the components shall not separate or settle out during the pot life of the adhesive.

The toxicity of the chemicals in the components must be low enough to enable safe usage on the construction site and in a normal workshop environment. If special ventilation is necessary such requirements shall be clearly stated on the containers.

(b) Working characteristics of adhesive**(i) Application**

The adhesive shall be suitable for application to prepared steel and concrete surfaces in a layer thickness of between 1,0m and 10m.

(ii) Pot life

The usable life (pot life) of the mixed adhesive before application to the substrate shall be at least 40 minutes at 20°C at a relatively high humidity.

(iii) Open time

The open time represents the time available after the application of the adhesive to the substrate to place the structural components and to close the joint. The period shall not be less than 20 minutes at temperatures up to 20°C.

(iv) Storage life

The storage life (shelf life) in the original sealed containers of both the resin and hardener shall not be less than 6 months at temperatures between 5° and 25°.

(v) Cure time and temperature

The adhesives shall be capable of curing to the required strength at temperatures between 10°C and 30°C in relative humidities of up to 95%.

The adhesive shall cure sufficiently within three days to confer the specified mechanical properties at 20°C and shall undergo a negligible shrinkage on curing (maximum linear shrinkage of 0,5%).

(c) Mechanical properties of cured adhesive

(i) Moisture resistance

The adhesive shall be formulated to minimize moisture transport through the adhesive itself. Water absorption shall not exceed 2% by mass after immersion for 24 hours in distilled water at 20°C.

(ii) Temperature resistance

The adhesives shall have a heat distortion temperature (HDT) of at least 50°C.

(iii) Flexural modulus

The instantaneous flexural modulus of the adhesive shall be between 2,0 GPa and 10,0 GPa at 20°C. The adhesive shall have a consistent static fatigue behaviour for temperatures ranging between –20°C to 40°C.

(iv) Shear strength

The bulk shear strength of the adhesive shall exceed 12 MPa at 20°C,

(v) Tensile strength

The tensile strength of the adhesive shall exceed 12 MPa at 20°C.

(vi) Double lap shear strength

The average lap shear strength of a double overlap joint at failure, using plates, shall not be less than 8 MPa at 20°C.

(d) Quality control

The adhesive manufacturer's quality control and conformance certificates and test results for each batch of adhesive supplied on site shall be made available to the engineer upon request.

The average test results shall meet the specification requirements and no single result shall deviate by more than 15% from the specified criteria.

(e) Packaging, handling and storage

All adhesive components shall be supplied in separate sealed containers of suitable sizes to obtain a workable quantity within the pot life of the adhesive. The components shall be packaged in the correct proportions so that the entire contents of each container mixed together shall produce a mix of the correct proportions. The adhesive properties shall not vary significantly with minor variations in the mix proportions resulting from the container emptying process.

Each container shall be durably and legibly marked and complete records of stock acquired and issued for use, shall be kept. The containers shall be clearly marked with the following information:

- (i) name of manufacturer
- (ii) manufacturer's product identification
- (iii) batch number and date of manufacture
- (iv) date of expiry and shelf life
- (v) manufacturer's instructions for mixing
- (vi) safety precautions, warnings for handling and toxicity
- (vii) manufacturer's recommendations for storage

(f) Manufacturer's instructions

The manufacturer shall provide a dated, coded and titled instruction sheet with each delivery of adhesive. The following information shall be contained on the sheet in a clear and unambiguous manner.

- (i) the general chemical type of each component used in the adhesive;
- (ii) recommended storage conditions and shelf life when stored under these conditions;
- (iii) preparation instructions for steel and concrete surfaces;
- (iv) Instructions for use of primers, including optimum film thickness and permissible ranges;
- (v) mixing instructions, including allowable variations in mix ratio and any temperature control requirements during the mixing process; (vi) application instructions, including limits on pressure, temperature, open time and relative humidity before mating the faying surfaces. It must also be stated whether adhesive should be applied to one or both adherents;
- (vii) maximum allowable interval between application of primer to coated steel or concrete, and application of adhesive and any primer reactivation procedure if applicable;
- (viii) safety precautions for all components of the adhesive and primer;
- (ix) curing conditions, including the amount of pressure to be applied, the period under pressure and the temperature of the assembly when under pressure. It must be stated whether this temperature is that of the adhesive layer or of the atmosphere in which the assembly is to be maintained or both. A graph of cure time against temperature shall be supplied; and
- (x) condition procedure before testing or use of the assembled product, including the time, temperature and relative humidity.

(g) Structural steel

Structural steel plates and sections shall comply with the following requirements:

Mild steel: grade 43C in accordance with BS4360 or,
Grade 300WC in accordance with SABS 1431
High-yield stress steel shall not be used.

The dimensions and properties of the rolled steel plate and sections shall conform to the structural steel tables as issued by the SA Institute of Steel Construction, as amended.

(h) Anchors, nuts and washers

Anchors shall consist of proprietary embedment type studs or bolts utilizing a chemical adhesive or mechanical expansion and locking systems to set the anchor in a concrete member. Certification and test results from a recognised approval authority or laboratory shall be made available at the request of the engineer.

F12 704 CONSTRUCTION

(a) Sequence of execution

The sequence of execution for the bonding of plates or reinforcement to the concrete surface shall be in accordance with the drawings and the approved method statement submitted by the contractor.

(b) Site preparation and access

The necessary access and temporary support structures shall be in place prior to the commencement of surface preparation. If deemed necessary to ensure acceptable environmental conditions and public safety, screening of the work area shall be established.

(c) Preparation of Concrete Surfaces

(i) Concrete surface for plate bonding

The outline positions of the plates shall be clearly marked on the receiving concrete surface. A covermeter survey shall be carried out in all regions where anchor studs are to be installed in order to accurately locate the existing reinforcement. The located bar positions must be clearly marked, and using this information, the stud positions can be determined.

The anchor stud positions shall be carefully measured up and transferred to the steel plate fabrication drawings. Particular care shall be taken with regard to the orientations and plate references during the survey and preparation of fabrication drawings.

Once the survey is completed the concrete surface shall be prepared.

Any cracks wider than 0,2mm shall be pressure injected using a low viscosity epoxy resin system in accordance with the procedures specified in Section 12 400.

Any concrete surface defects or deeper reinforcement corrosion within the plate outline and other areas considered defective shall be removed and repaired with suitable and compatible repair systems in accordance with Section 12 300 of this specification.

The marked concrete areas to be plated shall be grit-blasted to remove all concrete laitance, surface coatings and impregnants, organic growth, bituminous residues, oil, dirt and any other surface contamination. The surface must be sound and shall exhibit the coarse sand and aggregate texture to present a rough key to the adhesive.

The prepared surface profile must be checked using a 1m long profile edge and any areas deviating by more than 4mm from the profile edge must be marked.

Any high areas shall be removed with light scabbling equipment or needle guns and low areas can be filled with the adhesive to be used for the plate bonding. Normal grit-blasting preparation shall not remove more than 1,0mm of the concrete surface.

The engineer will inspect the prepared surface to identify areas that are defective or substandard which may require additional preparation and/or remedial work.

(ii) Concrete surfaces for bonding reinforcement in slots

The positions of the slots for reinforcement shall be clearly marked on the receiving concrete surface. A covermeter survey shall be carried out along each slot position to determine the position of existing reinforcement bars and the concrete cover thickness. The located bar positions must be clearly marked and the depth of the slots must be adjusted if necessary to avoid cutting reinforcement transverse to the direction of the slots. Where possible the slots must be located midway between existing reinforcement bars.

A covermeter capable of measuring concrete cover to reinforcement within 3mm accuracy shall be used.

Once the survey is completed, the slots can be cut into the concrete surface. Any cracks wider than 0,2mm and concrete surface defects and deeper reinforcement corrosion shall be treated as required in section 12 704(c)(i) above.

The slots for bonding the reinforcement shall be cut into the member at the positions and to the dimensions as indicated on the drawing or as directed by the engineer following the covermeter survey. The sides of the slots shall be neatly cut along the required profile using a diamond saw or angle grinder to the required depth. Holes within a slot shall be carefully drilled using a diamond drill. Equipment that may damage the adjacent material structure, soundness or integrity shall not be used.

The surfaces of the slots shall be free of loose or unsound material, and any contaminant that may react with or impair the bond of the adhesive to the concrete surface, shall be cleaned off.

The cut surfaces shall be prepared to exhibit a coarse sandpaper-like texture by grit-blasting, water-jetting or other approved means.

The engineer will inspect the concrete surface with prepared slots to identify areas that are defective or substandard and which may require additional preparation or remedial work.

(d) Preparation of steel plates for bonding

After the plates for bonding have been fabricated to size with all the required holes, the plate surface preparation shall be done. The plates must be handled with care to ensure that the flatness tolerances of BS 4360 are maintained in the final prepared plate.

(i) Corrosion protection using paint system

All physically adhering contaminants and residues shall be removed and the bond surface shall be grit-blasted to Sa 2 ½ surface finish in accordance with Swedish Standard SIS 05 59 00 to a surface profile of between 50 to 100 microns.

The steel surfaces shall preferably be prepared under factory conditions to ensure complete removal of rust, millscale, grease, dirt, etc. using gritblasting techniques with a clean, angular, hard metal grit free from contaminants.

Mechanical abrasion techniques such as wire brushing or emery cloth that polish rather than remove oxide layers are not acceptable.

No abrasive blasting shall be done outside factory conditions during rainy weather or where corrosive air conditions prevail.

Prepared steel surfaces must be primed within four hours of blast-cleaning to prevent re-oxidation of the steel surface. Immediately prior to the primer application the surface must be degreased and vacuum-cleaned to remove all dust and debris. The prime shall be applied to a dry film thickness (DFT) of 50 µm to 75 µm allowing for the full cure of the primer. The primer shall consist of a single-component, anti-corrosion compound based on zinc and epoxy resins compatible with the bonding adhesive.

The primed plates shall be allowed to cure for at least 24 hours before further handling or transportation is undertaken. Suitable precautions shall be taken to protect the primed plates against handling, transportation and storage damage. Plates with defective bond surfaces or out of tolerance flatness at the time of adhesive application of the adhesive will be rejected.

A suitable means of protection of plate condition is to cover the plates in a clean bubble wrap protection material with a silicon gel desiccant placed inside the wrapping to ensure that the plates are kept free from moisture.

(ii) Corrosion protection using hot-dip galvanizing

The surface preparation of steel plates for hot-dip galvanizing shall entail the mechanical removal of all millscale, rust and other adhering debris to achieve a minimum grade St 3 surface finish to Swedish Standard SIS 05 58 00. All galvanizing shall be done in accordance with SABS 763, heavy-duty coating.

After the steel plates have been galvanized, the surface to be bonded shall be abrasive-blasted as in section 12 704(d)(i) to remove the galvanizing layer and then primed and protected against damage during handling, transportation and storage.

The surrounding galvanized surface must be suitably protected against the abrasive blasting to ensure that the galvanizing is not damaged.

(e) Preparation of reinforced steel bars

The steel bar surface shall preferably be cleaned and abrasive-blasted immediately before bonding into the prepared slots in the concrete surface. Alternatively, approved measures must be taken to prevent surface corrosion and maintain the clean surfaces free from dirt, oil, or any other deleterious contaminants. The steel surface shall be prepared by removing all physically adhering contaminants and by abrasive blasting to grade Sa 2 ½ surface finish in accordance with Swedish Standard SIS 05 59 00. No abrasive-blasting shall be done during rainy weather or when corrosive environmental conditions prevail.

Blast profile to be 100-140 microns.

(f) Inspection of concrete surface prior to adhesive bonding

The prepared concrete surfaces or slots shall be carefully inspected immediately prior to application of the adhesive to ensure that the requirements of clause 12 704(c) are maintained. All bond surfaces must be dry or have a moisture content less than that recommended by the manufacturer of the selected adhesive. The surface temperature of the concrete must be between the temperature limits recommended by the adhesive manufacturer. Should the moisture content be excessive, the concrete surface must be allowed to dry sufficiently to prevent the possibility of a moisture barrier forming between the concrete substrate and the adhesive.

(g) Mixing of adhesive system components

The entire contents of a multi-component adhesive system shall be mixed together as recommended by the manufacturer and shall be used within the pot life of the adhesive.

The adhesive components shall be mixed in a clean container, free of harmful residue or foreign particles. The adhesive shall be carefully and thoroughly mixed to a uniform colour and a homogenous mixture. If necessary, the adhesive components must be conditioned to a temperature of between 10°C to 30°C unless recommended otherwise by the manufacturer in writing.

Sufficient adhesive shall be mixed to cover the necessary bonding surfaces which can be comfortably handled within the available period to ensure the necessary quality and workmanship.

Once the adhesive has been thoroughly mixed, no re-mixing will be allowed. In order to monitor the quality of the mixing process, flexural modulus tests on prisms made from the adhesive shall be undertaken. The results must be compared with the values specified by the manufacturer, and any discrepancies shall be listed.

(h) Application of the adhesive to the bond surfaces

Immediately before the application of the adhesive to the prepared concrete surface, the receiving surface must be vacuum-cleaned to remove all dust, debris, etc.

The mixed adhesive shall be trowelled onto the receiving concrete surface using plastering techniques. The adhesive must be well worked into the grit-blasted surface to a layer thickness of approximately 2,0mm. Skilled operators are essential due to the speed and care demanded by this phase of the work.

The adhesive shall be applied to bonding plates preferably with a specially profiled trowel to ensure a uniform thickness and profile across the plate width. The profile shall be such that when the plate is pushed into contact with the concrete surface the adhesive is squeezed out towards the free edges to reduce the risk of air entrapment. The minimum thickness of adhesive applied to the plate shall be 1,0mm at the edges.

The actual thickness applied to the plate and concrete surface shall be carefully controlled to ensure that sufficient quantity is used to achieve the required final layer thickness with minimal wastage.

In order to ensure a uniform adhesive layer thickness, suitable inert plastic spacers may be placed along the plate at regular intervals suited to the plate stiffness.

Once the adhesive is applied to the bond surfaces, the plate must be positioned with a suitable and adjustable support system to within 5mm of the required location. The position and alignment shall be checked against markers or guides and if correct, the plate must be pushed home against the concrete surface, pressuring the adhesive layer. Folding wedges provide a suitable means of final adjustment and locking into position of the plate for the curing phase.

The pressure applied must be sufficient to just squeeze out the adhesive along the full plate perimeter. Care must be taken to apply the pressure evenly without distortion of the plate.

Once the plate is in position, the edges must be neatly finished with a fillet of adhesive to protect the interface of the plate, adhesive layer and concrete against the ingress of moisture.

The support system shall be left undisturbed for a minimum period of 24 hours and the temperature variation shall be monitored during the initial curing period.

(i) Application of adhesive and placing of reinforcement bars to be bonded

The concrete slot and reinforcing steel surfaces receiving the adhesive shall be primed with a compatible primer approved by the engineer. While the primer is still tacky the slot must be filled with adhesive to a thickness sufficient to fill, with a slight excess, the gap between the concrete substrate and the reinforcement bar.

The reinforcement bar shall be placed and fixed into position within the slot using an approved method.

The remainder of the slot depth shall then be filled with adhesive to a slightly convex surface with respect to the surrounding concrete surface.

The elements being bonded shall not be disturbed during the curing period of the adhesive.

(j) Fixings and finishing

Anchor studs shall normally be installed after the plate-bonding adhesive has cured and the support system is removed.

The holes in the concrete are drilled through the holes in the steel plate using hand-held power drills with rotary hammer action.

The anchor studs shall be installed and set to the depth and detail as indicated on the drawings or the approved alternative anchor setting procedure recommended by the manufacturer.

The annular space between the stud and the plate must be filled with the same adhesive as used for the plate bonding.

Before the adhesive enters the curing phase the hole must be covered with a suitable washer and nut torqued to the specified value.

The plate fixing shall be finished off with a two-coat protective paint system applied by an airless spray extending 25mm beyond the plate outline. The final coat shall be of a colour similar to that of the surrounding concrete.

Excess hardened adhesive shall be carefully ground away to the required surface profile. Where the adhesive colour does not match the colour of the surrounding concrete surface, a compatible finishing paint of matching colour shall be applied to the area at the instruction of the engineer.

(k) Environmental protection and cleaning-up

Care shall be taken during any work with adhesive components to avoid contamination of the subsoil and the environment. Any spillage, wastage and clean-up residues shall be collected, removed and disposed of in suitable containers at an approved waste disposal site.

The concrete surface adjacent to the prepared surfaces receiving adhesive shall be protected against spillage where necessary. Any adhesive applied or spilled on unwanted areas must be immediately removed and cleaned with an approved clean-up material and procedure recommended for the desired purpose by the manufacturer.

F12 705 TOLERANCES

The positional and level tolerances of the bonded steel elements shall comply with those specified on the detail drawings, or if none is specified, as follows:

Position & Alignment: $\pm 5,0\text{mm}$ with max 1° angular deviation

Level: $\pm 1,0\text{mm}$

Flatness: $\pm 5\text{mm}$ deviation over a 2,0m long straight

F12 706 QUALITY ASSURANCE AND TESTING

The contractor shall submit to the engineer for approval the following:

(a) The adhesive manufacturer's certification verifying conformance to the specification of the material in Section 12 703 for each batch of epoxy delivered on site. The certification shall include the relevant laboratory test results.

(b) A detailed method statement for the execution of the work covered in this section including details of temporary works, work procedures and equipment to be used for mixing and placement of adhesive and bonding elements, quality assurance procedures and tests that have to be followed to ensure that the correct quality of workmanship is achieved as part of his quality control testing procedure.

The engineer may instruct the on-site monitoring, sampling and testing by an independent test laboratory to ensure that the required standard of adhesive mixing, application and performance is achieved.

Detailed records of all operations and inspections carried out and materials received, issued and tested shall be kept by the contractor and submitted to the engineer for record purposes.

F12 707 MEASUREMENT AND PAYMENT

Payment for items in this section shall include full compensation for all works associated with additional temporary works, execution of the work and quality assurance procedures which are not separately covered by the measurement and payitems of the Standard Specification or the Project Specifications. General access and work platforms and associated temporary works are covered in Section 12 100.

All work and material for which no specific payitem is defined shall be deemed to be covered by the items in this section.

| Item | Unit |
|--|----------------|
| F127.01 Moving to and setting up the equipment at each work site. (Description of location) | number (No) |

The unit of measurement shall be the number of sites where equipment had been set up for the preparation of surfaces and placement of bonded plates and bars.

The tendered rate shall include full compensation for all costs involved in moving to each location, setting up the equipment and later dismantling thereof, extra over the general access and work platform covered in Section 12 100.

| Item | Unit |
|---|-----------------------------------|
| F127.02 PREPARATION OF CONCRETE SURFACES | |
| (a)Concrete surfaces for plate bonding (position and size indicated) | square metre (m ²) |
| (b)Slots in concrete for steel bonding (position and size indicated) | metre (m) |

The unit of measurement shall be the square metre of concrete surface area repaired, and the metre of slots of the size specified.

The tendered rate shall include full compensation for all labour, materials, plant and equipment required for the cover and position survey of existing reinforcement, the measurement, recording and working on the concrete member, preparation of steel fabrication drawings, the surface preparation of the concrete surface and cutting of slots as required.

It shall also include the supply and application of an adhesive-compatible primer to the prepared concrete surfaced if required for the type of adhesive being used.

| Item | Unit | F127.03 Adhesive | litre (ℓ) (Description or type) to (location) |
|-------------|-------------|-------------------------|--|
|-------------|-------------|-------------------------|--|

The unit of measurement shall be the litre of adhesive used as approved by the engineer.

The volume shall be determined from the dimensions indicated on the detail drawings or as authorized by the engineer following the detailed inspection of the prepared surfaces.

Any overcut or excessive preparation resulting in additional adhesive quantities shall not be measured.

The tendered rate shall include full compensation for all labour, material, equipment, etc, required for the supply, mixing and application of the adhesive to the prepared concrete and steel surfaces, slots and holes. It shall also include the certification testing and quality assurance monitoring and testing by the contractor, as well as any wastage of mixed or spilled materials and the disposal thereof.

The rate shall also include all costs arising from any clean-up and finishing actions required due to spillage or poor workmanship.

| Item | Unit |
|---|-------------|
| F127.04 Bonded steel plates, bars or sections | |
| (a) Steel plates (description of unit, size and mass) | number |
| (b) Steel bars (type and size indicated) | (No) |
| (c) Steel sections (type and size indicated) | kilogram |
| (d) Steel elements (description) | (kg) |
| | number |
| | (No) |
| | number |
| | (No) |

The unit of measurement shall be the mass of steel bars or number of identified steel plates or described items bonded to the concrete member.

The tendered rate shall include full compensation for all labour, materials, plant, equipment etc, required for the fabrication and supply of the steel items on site, the placing and fixing of the steel items into position including all ties, fasteners, waste, etc complete as per details on the drawings. Fixing studs and bolts are measured separately.

It shall also include all costs arising from the surface preparation, corrosion protection and primer application to the steel bonding surface.

| Item | Unit |
|---|-------------|
| F127.05 Fixing studs and bolts (type and size indicated) | number |
| | (No) |

The tendered rate shall include full compensation for all labour, materials, plant and equipment required to supply and install the described fixing studs or bolts in accordance with the detail drawings, including the drilling and preparation of holes, the application of adhesive and the installation and tightening of the fixings with washers and nuts.

| Item | Unit |
|---|--|
| F127.06 Protective paint coatings indicated) | square metre (m ²) (type and film thickness indicated) |

The unit of measurement shall be the square metre of surface area covered by the paint coating measured in place.

The tendered rate shall include full compensation for all labour, materials, plant and equipment required to prepare the surfaces and to supply and apply the protective coating and primer to the required film thickness.

F12 908 MEASUREMENT AND PAYMENT

| Item | Unit |
|---|-------------|
| F129.01 Concrete cover survey (description of location) Lump Sum | |

The unit of measurement shall be a lump sum

The tendered rate shall include full compensation for all labour, material and testing equipment required to execute the work and the recording of results. This work will be paid for by way of a lump sum, 75% of which will become payable when the enforcement has been identified, and the remaining 25% will become payable after all work has been completed on the structure.

B17. SECTION F12 1100: REPAIR OF CORRODED STEEL ITEMS

F12 1301 SCOPE

This section covers the work in connection with the removal, refurbishment and reattachment of corroded steel items.

F12 1302 EXECUTION OF WORK

Corroded or badly fitting steel ancillary items shall be refurbished when instructed by the engineer.

The items will be carefully removed from their installed positions without damaging the surrounding concrete or other steel items, taken off site and made to fit the structure correctly or cleaned up as the case may be and sand blasted in preparation for hot dip galvanising. After they have been hot dipped galvanised, they will be returned to site and re-installed in their original positions, utilising new galvanised mild steel bolts to suit their application if necessary.

F12 1303 QUALITY STANDARD

All hot dip galvanising shall be done in accordance with SABS 763 (as amended in 1998), and the minimum coating thickness for all elements shall be 85 microns (600g/m²). All items shall be sand blasted to remove all existing corrosion protection and/or corrosion.

The correct shape and size of ill-fitting items shall be requested from the engineer who shall either issue standard SANRAL drawings from which the dimensions shall be derived, or provide such general dimensions in writing as are appropriate to the structure concerned. The contractor shall then be fully responsible for ensuring that the item removed for refurbishment will fit to generally accepted tolerances onto the structure once it is reinstalled.

The contractor shall ensure that the structure from which the steel element was removed, remains in a safe condition, specifically where the removal of the item may have a negative impact on the safety of the public. In this regard, any and all necessary supports, signage, danger tape etc shall be utilised by the contractor.

F12 1304 MEASUREMENT AND PAYMENT

| Item | Unit |
|--|-------------|
| F12 13.01 Refurbishment of (Describe item) | number (No) |

The unit of measurement shall be the number of whole items, as described which are removed, refurbished and re-installed.

The tendered rate shall include full compensation for all labour and equipment required for the relevant items from the structure, inclusive of the complete repair of any damage done to the structure in the process as well as for the cutting and trimming of the steel element or of welding new compatible sections onto the element such that it conforms to the correct size and shape. It shall also cover the cost of transport to and from a hot dip galvanising factory, preparation for and hot dip galvanising and the re-installation of the element in its proper place and orientation. It shall further cover all and any costs pertaining to the making safe of the structure from which the element was removed for the duration of the refurbishment process.

| Item | Unit |
|--|-------------|
| B12 13.02 Remove existing structural steelwork (Describe item) | tons (t) |

The unit of measurement shall be tons, as described which are removed and discarded.

The tendered rate shall include full compensation for all labour and equipment required for the relevant items from the structure. It shall further cover all and any costs pertaining to the making safe of the structure from which the element was removed for the duration of the refurbishment process.

B18. SECTION B1000 : MECHANICAL AND ELECTRICAL WORKS

B1001 SCOPE

This section shall comprise all the work involved with the supply, installation and commissioning of the mechanical and electrical components of the works.

B1002 SELECTED SUBCONTRACT

To undertake the mechanical and electrical work separate tenders will be called for. The successful tenderers (hereinafter called the "Selected Subcontractor") shall then be nominated by the Employer to perform all the required mechanical and electrical work that forms part of this project. The Selected Subcontractor shall be employed by the Contractor and shall be solely responsible to him. Provisional Sums for this work have been allowed for in the Bill of Quantities.

Copies of relevant drawings are not enclosed with the Documents

By accepting a selected Subcontract, it shall be deemed that the Contractor is fully acquainted with the Specifications for the electrical work and the Employer will accept no responsibility for failure on the Contractors part to do so.

B1003 MEASUREMENT AND PAYMENT

| Item | Unit |
|--|------------------------|
| B10.01 Mechanical Works | |
| (a) Mechanical Work as per "Selected" Subcontract for execution of the works | prime cost (PC) sum |
| (b) Handling cost and profit in respect of subitem B10.01(a) | percentage (%) |
| B10.02 Electrical Works | |
| (a) Electrical Work as per "Selected" Subcontract for execution of the works | prime cost (PC) sum |
| (b) Handling cost and profit in respect of subitem B10.02(a) | percentage (%) |

The Prime cost item shall be paid in accordance with the provisions of the General Conditions of Contract.

The Contractor is to note that provision is to be made for a handover from FOSKOR to the Contractor, and a takeover from the Contractor to FOSKOR once the work has been completed.

The tendered percentage is a percentage of the amount actually spent under the prime-cost item, which shall include full compensation for the profit in connection with providing the specified service."

B19. SECTION B2000 : DAYWORKS B2001 SCOPE

This section shall comprise of rates for LABOUR and PLANT.

B2002 MEASUREMENT AND PAYMENT

Item Unit B20.01 Labour

- | | |
|----------------------------------|----------|
| (a) Specify the type of labourer | hour (h) |
|----------------------------------|----------|

The measuring unit is hours.

The rates entered against each item shall provide for the actual wages paid to employees and shall include all allowances and benefits, the cost of supervision, use of small tools etc.

Item Unit B20.02 Plant

- | | |
|-----------------------------------|----------|
| (a) Specify the type of equipment | hour (h) |
|-----------------------------------|----------|



The measuring unit is hours.



This rate should be inclusive of all expenses such as plant operators, running costs, fuel and maintenance and establishment on site.

Scope of work reviewed (per Bid Spec Committee 24/10/2023)