

TRANSNET SOC LIMITED

TENDER NO.: TNPA/2022/08/0910/10166/RFP - DESCRIPTION OF THE WORKS: PROVISION OF SCOUR PROTECTION FOR BERTH A TO B AT THE PORT OF DURBAN

ADDENDUM NO. 002

DATED 24 October 2022

The following information is furnished in addition to, in amplification and substitution of, matters contained in the tender documents issued in respect of the abovementioned work.

1. PART C3: SCOPE OF WORK

Annexure B - Technical Project Specifications was erroneously omitted.

2. PART 2: PRICING DATA, C2.2 the Bill of Quantities

Replace existing **C2.2 Bill of Quantities** with attached **C2.2 Bill of Quantities** in its entirety.

WITNESSES:

1. _____

TENDERER / CONTRACTOR

2. _____

WITNESSES:

1. Shani Evans 

Zama Zuma



TRANSNET SOC LIMITED

2. Jo-Ann McCann 

FROM : _____

DATE : _____

TO : **Transnet National Ports Authority**
237 Mahatma Gandhi Road
Durban
4000
(Attention: Mrs S Evans - Email. Shani.kleyn@transnet.net)

Dear Sirs / Madam

TENDER NO. TNPA/2022/08/0910/10166/RFP - DESCRIPTION OF THE WORKS: PROVISION OF SCOUR PROTECTION FOR BERTH A TO B AT THE PORT OF DURBAN

Receipt of **Addendum No. 002** dated **24 October 2022** is hereby acknowledged.

Kind regards

TENDERER

NOTE: This acknowledgement must be signed and returned to this office on or before closing date of tender.

Ref: TNPA/2022/08/0910/10166/RFP

Item	Description	Units	Qty	Rate	Amount
SECTION A : PRELIMINARY & GENERAL					
Preambles					
Fixed preliminary items will be valued and paid on a proven cost basis. Time related preliminary items may relate to fixed preliminary items and items not listed and expressed as a sum and will be pro-rated against value of construction items completed.					
A.1	FIXED CHARGED ITEMS				
A1.1	Contractual requirements, as per NEC3 ECC including all performance bonds, insurances etc.	Sum	1		R
Establishment of facilities on site					
A1.2	Offices for Engineer & Staff	sum	1		R
A1.3	Offices for the Employer	sum	1		R
Establishment of facilities for contractor					
A1.4	Nameboards, monthly progress photos and time lapse video	Sum	1		R
A1.5	Offices and storage sheds	Sum	1		R
A1.6	Ablution and latrine facilities	Sum	1		R
A1.7	Tools and equipment	Sum	1		R
A1.8	Water supplies, electric power and communications	Sum	1		R
A1.9	Dealing with water	Sum	1		R
A1.10	Access	Sum	1		R
A1.11	Plant	Sum	1		R
Other Fixed-charge Obligations:					
A1.12	Survey, setting out and preparation of as-built drawings	sum	1		R
A1.13	Health and Safety incl. COVID-19 Compliance	Sum	1		R
A1.14	Environmental management	Sum	1		R
A1.15	Security	Sum	1		R
A1.16	Dealing with Traffic	Sum	1		R
A1.17	Removal of Site Establishment	Sum	1		R
A1.18	Skills Transfer	Sum	1		R
A1.19	All other fixed charge obligations not covered elsewhere - tender to specify	Sum	1		R
A2	TIME RELATED ITEMS				
A2.1	Survey assistants and materials	month	7		R
Establishment of facilities for engineer:					
A2.2	Offices for Engineer & Staff	month	7		R
A2.3	Offices for the Employer	month	7		R
Establishment of Facilities for contractor:					
A2.4	Offices and storage sheds	month	7		R
A2.5	Ablution and latrine facilities	month	7		R
A2.6	Tools and equipment	month	7		R
A2.7	Water supplies, electric power and communications	month	7		R
A2.8	Dealing with water	month	7		R
A2.9	Access	month	7		R
A2.10	Plant	month	7		R
A2.11	Company and head office overhead costs for duration of construction	month	7		R
A2.12	Comply with all Regulations and Requirements that speaks to the works	month	7		R
Supervision					
A2.13	Supervision for the duration of Construction	month	7		R
Other time related obligations:					
A2.14	Compliance Occupational Health and Safety Act and Construction Regulations	month	7		R
A2.15	Compliance to Environmental Management Plan	month	7		R
Section Summary					

SECTION B: CIVIL WORKS					
B.1	Site Clearance				
B1.1	Clear Site and remove scrap material to an approved dump site	m2	9000		R
B.2	Bathymetric Surveys (in and out)				
B2.1	Bathymetric Surveys				
B2.1(a)	Establishment for bathymetric surveys	No	2		R
B2.1(b)	Multi beam echo sounder survey (in-survey)	m2	15000		R
B2.1(c)	Multi beam echo sounder survey (out-survey)	m2	15000		R
B2.1(d)	Allowance for in-between Multi beam echo sounder survey	sum	1		R
B.3	Scour Protection				
B3.1(a)	Surface Preparation and levelling	m2	15000		R
B3.1(b)	Provide Primary Rock Material (200kg - 400kg)	(m3) -t	(15000) 45000		R
B3.1(c)	Provide and place double layer geotextile 20mm thick including turn up adjacent to existing quay wall				
B3.1(d)	Installation and placement of 1000mm thick rock scour protection adjacent to existing quay wall	m3	15000		R
B.4	DREDGING				
B4.1	Provisonal Sum for the mobilization of dredging equipment, dredging, profile material and disposal of dredged material	P.Sum	1	R	1 100 000,00
Section Summary					R
					-

DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION 1 BILL 1: PRELIMINARIES AND GENERALS				R
SECTION NO. 2: CIVIL WORKS				R
SUB-TOTAL				R
TOTAL				

ANNEXURE A3: PARTICULAR SPECIFICATIONS – PROVISION OF SCOUR PROTECTION AT A TO B BERTH

Document reference	Title	No of pages
	Particular Specifications	20
	Total number of pages	20

Annexure A

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1 SCOPE

1.1 General

The *works* that the *Contractor* is to perform involve the provision of scour protection at A to B berth (between bollard 8 to bollard 33), Port of Durban.

The installation of scour protection is required to strengthen the toe of the quay wall that might be affected due to the high pressures to be experienced from ships propellers, bow thrusters, wave run up and backwash, wave reflection, grain size distribution of the bottom material. The scour protection will further mitigate the risk of quay wall undermining

The specification provides definitions and requirements for the construction, production, testing, transport, placement and survey of quarried stone materials to be sourced from local quarries or from alternative sources where applicable, for use in the construction of the rock scour protection.

The *Contractor* shall be responsible for ensuring that rock conforming to this specification can be supplied from existing licensed quarries that are at the rates required to complete the works on time. The *Contractor* must satisfy himself that the available quarries are capable of supplying rock of the sizes, quality and quantity required. The logistics of transporting rock to site through the city could be challenging and the *Contractor* needs to take this into account in planning the transport mode and route.

The construction of the scour protection includes for the procurement of specified gradings of rock from a quarry licensed by the Department of Mineral Resources and Energy in the Durban area or alternative quarry sites.

1.2 Extent

The works that the Contractor is to perform involve the supply and install of scour protection at A to B berth (between bollard 8 to bollard 33), Port of Durban. The length of the scour protection is approximately 500m with a water depth of ± 10.5 m CD. The scour protection comprises of a geotextile filter and graded rock layers.

2 INTERPRETATIONS

2.1 Standardised Specifications

This specification is read in conjunction with the following standardised specifications:

- a) SANS 1200 A: PSA: General
- b) SANS 1200 C: PSC: Site Clearance
- c) SANS 1200 D: PSD: Earthwork

2.2 Definitions

For the purposes of this specification the definitions and abbreviations given in SANS 1200-A and the following definitions shall apply:

Rock: Natural rock material imported from a quarry or sourced from demolished structures and utilized in the works according to specified gradings.

Tonne: (abbreviated t): metric ton, 1000kg.

Quarried stone: Broken, natural stone.

Graded quarry stone: Quarried stone which is graded by sieve sizes or by weight of the stone.

Fine-graded quarry stone: A grading which is determined with the aid of sieve sizes.

Light-graded quarry stone: A quarried stone grading which is determined by weight or size of stone for mean weights less than 300 kg per stone.

Heavy-graded quarry stone: A quarried stone grading which is determined by weight for stones of mean weight of at least 300 kg.

Stone fragment: A piece of stone in a grading with a lesser weight or size than the extreme lower-class limit (ELCL) for that particular grading class.

Effective mean weight W_{em} : The arithmetic average weight of all blocks in a sample excluding any stone fragments.

Nominal stone diameter D_n : The nominal stone diameter, D_n , is calculated as the cube root of the volume of the stone. The volume is calculated by dividing the mass of the stone by the saturated surface dry density. Where a numbered subscript is given to D_n , this refers to the percentage by weight of stones in the grading having a smaller nominal stone diameter.

Class limits: The size (or weight) defined for each rock grading together with the allowable percentage of a sample that can lie beyond that limit, is as follows:

Extreme lower class limit (ELCL)

Lower class limit (LCL) Upper class limit (UCL)

Extreme upper class limit (EUCL)

3 MATERIALS

3.1 Rock to be provided by Contractor

Gradings

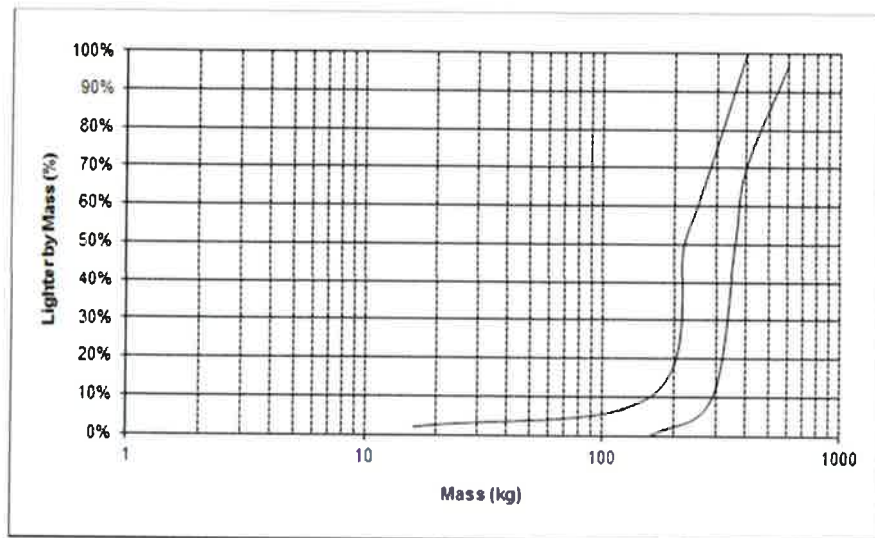
Gradings are determined in accordance with 7.3.1

The following rock gradings are required in the works:

CATEGORY	GROUP	DESIGNATION
Scour Protection	Light Grading	200 kg – 400 kg

Scour Protection

Class Limit	Definitions	% by Weight Smaller
ELCL	16 kg	< 2%
LCL	200 kg	0 – 10%
UCL	400 kg	70 – 100%
EUCL	600 kg	>97%



Shape

Sampling is carried out in accordance with 7.2, using at least 50 pieces taken at random from stones greater in weight than the ELCL. Measurement and reporting is in accordance with 7.3.2.

The quarry stone sample does not contain more than 5% of stones with length to thickness ratio (l/d) greater than 3, where the length, l , is defined as the greatest distance between two points on the stone and the thickness, d , as the minimum distance between two parallel straight lines through which the stone can just pass.

3.2 Rock quality requirements

3.2.1. General

All results for rock quality tests refer to samples taken in accordance with 7.2

3.2.2. Density

The average density of quarry stone is at least 2 700 kg/m³ with 90% of the stones having a density of at least 2 600 kg/m³. For sampling, testing and reporting in accordance with 7.3.3, ten density determinations are made, each determination being carried out on a different randomly selected stone, which has a volume of at least 50 ml. If any stone is too large, a representative part of at least 50 ml is taken.

3.2.3. Water absorption

The average water absorption of quarry stone is less than 2%, and the water absorption of nine of the individual stones less than 2.5%. For sampling, testing and reporting in accordance with 7.3.4, ten water absorption determinations are made, each determination being carried out on a different randomly selected stone, which has a volume between 50 and 150 ml. If any stone is larger than 150 ml, a representative part of between 50 and 150 ml is taken.

3.2.4. Resistance to impact and mineral fabric breakage

The average point load index (in the planar direction of the most pronounced layering, should any visible anisotropy exist) done in accordance with the ISRM 1985 recommended method for sampling, testing and reporting is at least 4,0 MPa with the average minus the standard deviation of the point load index being at least 3,0 MPa. The average and standard deviation is calculated from at least ten valid results obtained from pieces of randomly selected stones after the largest and smallest valid test results have been excluded from the calculation. In practice this will mean that at least twelve test results will be required.

3.2.5. Impurities

Quarried rock does not contain visually observable or chemically detectable impurities or foreign matter in such quantities as are damaging to the constructive application of the quarried stone, or for the environment in which the quarried stone is applied.

3.3 Filter Fabric

The transition between the cover layers and the finer materials which make up the dredged seabed and slopes is achieved by means of a geotextile filter. The filter should prevent the transport through the fabric of fine particles but allow for the transport of water.

The geotextile shall be a nonwoven continuous filament needle-punched polyester material. It shall be manufactured under a quality management system that is third party certified to ISO 9001:2000 standards.

Geotextile filaments shall be rot-proof, chemically stable and shall have low water absorbency. Filaments shall resist delamination and maintain their relative dimensional stability in the geotextile.

Geotextiles shall be free of flaws that may have an adverse effect on the physical and mechanical properties of the fabric.

General requirements for a geotextile filter are different for granular materials and cohesive materials

Granular materials such as medium to coarse sands ($d_{85} > 2.0\text{mm}$) and coarse silts and fine sands ($d_{85} > 0.075\text{mm}$; $< 0.6\text{mm}$) cover the majority of the sea bed area.

The geotextile shall conform to the properties given in table below.

Property	Units	Value	Test Method
Trapezoidal Tear Strength	N	>645	ASTM D4533-85
Tensile Strength, minimum	kN/m	>26	SANS 0221-88
Tensile Strength, elongation	%	40 - 60	SANS 0221-88
CBR Puncture	kN	>4.5	SANS 0221-88
Pore size (apparent opening size) O_{95H}	um	50 - 150	NFG 38.C17
Permeability	m/s	$> 1 \cdot 10^{-5}$	SANS 0221-88
Porosity under 2 kPa	%	>60	Calculation

The *Contractor* shall submit to the *Engineer* certified test results and statements of quality that show without exception that the proposed geotextile meets the requirement of the specification.

4 PLANT AND EQUIPMENT

4.1 General

The *Contractor* provides for all the necessary equipment to deliver the specified rock quality and gradings, transport the rock to the site and place the scour protection, as shown on the drawings, to the required tolerances. The *Contractor* further provides equipment for the accurate control of placing the rock and for surveying of the scour protection layers, to prove compliance with the relevant tolerances.

The requirements of SANS 1200 D (clause 4.3) apply to all vehicles that are required to operate over any public road. Spillage of materials, generation of dust, or contamination of public roads with mud from the site is controlled.

Audible reversing warning signals are provided for all transport vehicles exceeding 3 tGVM.

4.2 Marine Equipment

The *Contractor* complies with the Harbour Master requirements for marine activities.

4.3 Survey Equipment

The *Contractor* to source and provide survey equipment that complies with the Harbour Master requirements for marine activities to undertake the in-survey and out-survey.

5 EXECUTION

5.1 Scour Protection

Scour protection seaward of the existing quay walls is provided in the form of unconfined stone laid in a single lift of a 800mm layer of 200 kg – 400 kg scour protection on filter fabric as shown on the drawings.

Prior to placing the scour protection, the filter fabric is made continuous either by firmly stitching together using double stitching with 500 mm overlap, or by providing overlaps of not less than 1 500 mm. The fabric is laid with care to avoid overstretching or puncturing of the fabric during and after laying thereof. When un-stitched laps are used, acceptable measures are implemented to ensure that the 1 500 mm overlaps are maintained until the scour protection is in position.

5.2 Transportation and Placing of Rock

Quarried rock, placed in the Works in bulk, is transported and handled in such a manner as to minimise segregation and breakage of the rock.

For placing below water level, techniques such as end tipping and dumping from barges may be used, providing the work is organised in such a way as to minimize

segregation of the stone grading and to ensure the specified dimensions or weight per unit area.

5.3 Filter Fabric

All geotextile shall be wrapped in opaque UV and moisture resistant plastic sheeting to prevent any damage prior to installation.

All geotextile shall be stored to prevent damage by impact and UV degradation and the method of storage shall be in accordance with any recommendations set by the manufacturer.

Geotextile shall not be exposed to temperatures in excess of those recommended by the manufacturer or 60 ° C, whichever is less. Outdoor storage shall not be for periods that exceed the manufacturer's recommendations or 2 months, whichever is less. Geotextiles shall not be exposed to direct sunlight prior to installation for more than 14 days.

The geotextile filters shall be laid on prepared surfaces in accordance with the manufacturer's recommendations. On sloping surfaces, the fabric shall be laid with its longitudinal axis down the slope. The geotextile shall be installed in the positions and to the lines and levels described on the drawings. Folds shall be avoided to obtain the best contact between the geotextile and the material beneath to be filtered. Material that may be in contact with the geotextile shall not have protrusions, which are likely to damage the geotextile during installation or in service. Construction plant shall not operate directly on the geotextile.

Any sheet of geotextile damaged or torn during installation shall be removed from the works and replaced at no additional cost to the *Employer*.

6 TOLERANCES

6.1 Rock Quality

The allowable tolerances for rock grading, shape, density and resistance to impact are given in 3.1

6.2 Placement of Scour Protection

The top of the scour protection layer is constructed to a tolerance of +0 mm to -100 mm on average from the levels shown on the drawings. Local deviations over areas not exceeding 4 m²

Testing and Surveys

6.3 Inspection

The requirements of 3.1 inclusive, apply to inspection at or near the site.

For inspections carried out at the quarry, the interpretation of inspection results takes into account the possible influence of storage, loading, transporting and unloading on the quality requirements in 3.1 inclusive.

7 TESTING AND SURVEYS

7.1 Inspection

The requirements of 3.1 inclusive, apply to inspection at or near the site. For inspections carried out at the quarry, the interpretation of inspection results takes into account the possible influence of storage, loading, transporting and unloading on the quality requirements in 3.1 inclusive.

7.2 Sampling

7.2.1 General

Samples for the grading of quarried stone are taken at random and must be representative. The sampling, transport and transfer of the samples are carried out so that breakage is limited to a minimum.

The pieces of one stone, which, according to observation, were broken during sampling, will be considered to comprise one stone at the inspection.

7.2.2 Homogeneity of the batch

When, on the basis of visual judgement of the quarried rock batch to be inspected, non-homogeneity or possible non-homogeneity of the batch is considered to exist with regard to one or more of the relevant qualities, that batch is divided into parts considered to be homogeneous. Sampling is then carried out on the individual parts.

- When one of the parts does not satisfy the requirements, the whole batch of quarried stone is considered unsatisfactory.

If separation of the divided part(s), which does (do) not satisfy the requirements, is possible without difficulty, the remaining part of the batch may be regarded as a separate batch.

7.2.3 Size and composition of samples

7.2.3.1 *Samples for determining particle distribution*

For the determination of the particle distribution of a fine-graded quarry stone, at least six sub-samples are taken if the sampling takes place from a stockpile or a ship's load. In all other cases the number of sub-samples is at least three.

The numerical value of the weight in kilograms of each sub-sample is at least equal to the numerical value of the upper limit in millimetres of the designation of the grading concerned, if that upper limit is less than or equal to 100 mm. The numerical value of the weight of each sub-sample, in kilograms, is at least twice the numerical value of the upper limit in millimetres of the grading designation if the upper limit is greater than 100 mm.

7.2.3.2 Samples for determining weight distribution

For the determination of the weight distribution of the light or heavy graded quarry stone, at least six sub-samples are taken if the sampling takes place from a stockpile or a ship's load. In all other cases the number is at least three.

The sub-samples, including all the rock fragments, together constitute one sample. This sample must contain at least 200 pieces of stone heavier than the extreme lower class limit of the designated grading class.

When the determination of the weight distribution concerns a ship's load containing less than 200 pieces of stone, the whole load is taken to be one sample.

7.2.3.3 Samples for determining shape and rock quality

The numbers of stones of specified sizes constituting samples for rock shape and quality tests are as enumerated in 7.2.3.1 and 7.2.3.2.

The stones are chosen at random from the sub-samples, which have been taken for the particle and weight distributions. Where such samples are not available, the stones are taken at random from the batch to be inspected. If the chosen pieces of stone are too large for the test descriptions in force, it will be necessary to break from each stone a representative piece of the required dimensions.

7.2.3.4 Samples for determining grading designated by size and average weight

At least four sub-samples are taken if sampling is from a ship's load or from a stockpile. In all other cases, the number is at least two.

The sub-samples, including all rock fragments, together constitute one sample. This sample must contain at least 100 pieces of stone retained on the L square hole of size 500 mm x 500 mm for the Light Grading class.

7.2.4 Method of recovering samples

7.2.4.1 General

It is ensured that, during sampling, the degree of filling of the grab, or other extraction equipment, does not adversely affect the representivity of the sample recovered.

7.2.4.2 Sampling from a belt conveyor

Prior to sampling material on the belt conveyor, the belt is allowed to transport for a period which is sufficient to ensure that deviations from the composition of the material due to the starting up of the installation are excluded from the sample. A sample of a sufficient quantity is taken by collecting it from the end of the belt, or by stopping the belt and recovering material from the belt.

The required number of sub-samples is taken at approximately equal intervals during the transportation of the batch.

7.2.4.3 Sampling from a silo

The required number of sub-samples is taken at approximately equal intervals during discharge from the whole batch to be sampled.

If during the sampling, segregation is observed, the number of samples is adjusted accordingly.

7.2.4.4 Sampling from a stockpile

When sampling from a stockpile, the necessary care is exercised to ensure that representative samples are recovered, taking into account possible segregation in the stockpile, and avoiding distortion of the sample grading by the method of recovery used.

7.2.4.5 Sampling from floating equipment

Samples are taken generally at the mid-height and on both sides of the cones of rock in the barge in such a way as to ensure that a representative sample is obtained

When sampling during unloading, the required number of sub-samples are taken at approximately equal intervals from the whole of the load to be sampled

7.2.4.6 Sampling from wheeled transport

The necessary care is exercised to ensure that representative samples are recovered. This may entail the tipping and distribution of the load in such a way that representative samples may be recovered, or by such other method as may be approved by the *Supervisor*.

7.2.4.7 Splitting of samples (light and fine gradings)

Where the splitting of samples is required, such splitting is undertaken in such a way that the sample grading is similar to the grading of the material being sampled, to the satisfaction of the *Supervisor*.

7.2.4.8 Transportation and identification of the samples

For the transportation of a sample, precautions are taken to avoid loss or deterioration of the material, and to ensure that the sample is not contaminated. All samples are accompanied by a certificate which contains the following information:

- A reference to this specification.
- The name of the producer and location of the quarry.
- The description and class designation of the grading.
- The number of stone pieces in the sample.
- Details on location and method of sampling, including the date of sampling.
- The name of the individual who took the sample.

7.3 Testing Procedures

7.3.1. Determination of gradings

7.3.1.1. *Equipment and other aids required*

- Weighing equipment, accurate to 2% of the LCL
- Lifting equipment and lifting aids for pieces that cannot be moved manually.

7.3.1.2. *Weighing*

Weigh each stone heavier than the ELCL separately (W_i), and all pieces lighter than the ELCL (the stone fragments) together (W_s), accurate to 2% of the LCL. Record the total weights falling in each weight fraction together with the total number of stones (n), heavier than the ELCL

7.3.1.3. *Calculation*

Calculate the total weight W_i of pieces equal to or heavier than the ELCL.

To obtain the cumulative curve where W_y is the weight for which the fraction y is lighter, calculate the successive points on the curve at weight intervals given below:

Weight interval (kg)
Less than 5
5 – 50
50 – 100
100 – 200
200 – 500
500 – 1000
1000 – 1500

To obtain only those values of y for which a requirement has been set, i.e. the fractions corresponding to W_y at the ELCL, LCL, UCL and EUCL, calculate the total weight W_n , for W_y corresponding to each of the four class limits, with the formula:

$$y = \frac{W_n * 100}{W_s + \Sigma W_i}$$

where:

- W_n = the total weight of stones lighter than W_y (kg).
- ΣW_i = the total weight of all pieces heavier than the ELCL (kg).
- W_s = the total weight of pieces lighter than the ELCL (kg).

Calculate the effective mean weight, W_{em} , to the nearest kilogram, using the formula:

$$W_{em} = \frac{\Sigma W_i}{n}$$

where:

- W_{em} = the effective mean weight of the stone sample which equals the averageweight of stones heavier than the ELCL,
- N = the number of stones heavier than the ELCL.

7.3.1.4. *Report*

The following data is included in the report:

- The measured cumulative percentage by weight passing the EL, L and EU holes.
- The average weight of pieces not passing the L hole.
- The rock density tested according to Section 7.3.3.
- A reference to this specification.
- A description of the sample; including its weight.
- The source of the sample.
- The date of the inspection.

7.3.2. Determination of shape

7.3.2.1. *Sample for analysis*

The sample contains at least 50 pieces taken at random from above the ELCL weight.

7.3.2.2. *Equipment and other aids*

Measurement apparatus required for the determination of length and thickness of stones with an accuracy of 3% or better.

Weighing equipment is accurate to within 2% of the lightest piece to be weighed.

7.3.2.3. Execution

Measure the length of each stone as the maximum distance between two points on the stone to within 3% accuracy. Measure the thickness of each stone defined as the minimum distance between two parallel straight lines through which the stone can just pass to within 3% accuracy. Weight the total weight (W_3), of the stones with a length-to-thickness ratio of greater than 3 to within 2% accuracy. Determine the total weight (W_t), of the stones accurately to within 2%. Determine the number of stones with length-to-thickness ratio greater than 3 (n_3), and the number of stones with length-to-thickness ratio greater than 2 (n_2). Count the total number of stones, n .

7.3.2.4. Calculations

Calculate the weight in percentage, rounded to the nearest 1%, of stones with length-to-thickness ratio of greater than 3 using the formula:

$$Cw_3 = \frac{W_3}{W_t} * 100$$

Calculate the number per cent of stones with length-to-thickness ratio greater than 3 and 2 using the formula:

$$Cn_3 = \frac{n_3}{n} * 100$$

$$Cn_2 = \frac{n_2}{n} * 100$$

7.3.2.5. Report

The report provides the following data:

- The percentage by weight of stones with length-to-thickness ratio greater than 3
- The percentage by number of stones with length-to-thickness ratio greater than 3, and greater than 2
- A reference to this specification
- A description of the sample, including the weight and the number of stones

-
- The source of the sample
 - Date of the test

7.3.3. Determination of rock density

7.3.3.1. *Subject and area of application*

This method is for the density determination of natural stone and stone-type material with a volume of at least 50 ml.

7.3.3.2. *Sample for analysis*

If the stones have a volume substantially in excess of 50 ml, a representative part can be used, subject to a minimum volume of 50 ml.

7.3.3.3. *Equipment and other aids*

- Drying oven, adjustable to $(110 \pm 5)^{\circ}\text{C}$.
- Weighing scales, accurate to 0.05% of the stone weight, suitable for weighing in air and under water.
- Water-bath, filled with tap water at room temperature and suitable for weighing stones under water.
- Thermometers, suitable for recording temperature in the water bath, accurate to 1°C .
- Moist chamois leather.

7.3.3.4. *Execution*

Remove loose grit and clean the stone by brushing with water. Measure the water temperature in the water-bath to 1°C accuracy. Keep the stone submerged in water at room temperature for at least 5 min and weigh it submerged (m_1), to an accuracy of 0.05%.

Dry the stone using a moist chamois leather to the point that no shiny-wet surface remains. Weigh the stone (m_2) again to 0.05% accuracy.

Dry the stone in the oven to a constant (steady) weight, which is reached when two consecutive weighings with a 24-hour interval show less than 0.05% loss of total weight.

Weigh the stone again after cooling to room temperature (m_3) to 0.5% accuracy.

7.3.3.5. *Calculation*

Calculate the density of the stone in kg/m^3 , rounded to 1 kg/m^3 using the formula:

$$\rho_r = \frac{m_3 \cdot \rho}{m_2 - m_1}$$

- where ρ_r = the density of the stone
 ρ = water density (g/ml) at the test temperature of the water-bath;
 m_1 = apparent weight of the stone submerged (g),
 m_2 = weight of the damp stone (g).
 m_3 = weight of the dry stone (g).

7.3.3.6. *Report*

The report includes the following:

- Density of the stone
- Reference to this specification
- A description, including the weight of the stone
- Source of the stone
- Date of testing

7.3.4. Determination of water absorption at atmospheric pressure

7.3.4.1. *Subject and area of application*

This method is for the determination of the water absorption at atmospheric pressure of a natural stone or other stone-type material, having a volume of at least 50 ml.

7.3.4.2. *Sample for analysis*

The stone has a volume of between 50 ml and 150 ml.

7.3.4.3. *Equipment and other aids*

- Drying oven or other appropriate apparatus, adjustable to $(110 \pm 5)^{\circ}\text{C}$.
- Weighing scales, accurate to 0.05% of the weight of the stone.
- Water-bath filled with tap water at room temperature.
- Moist chamois leather.

7.3.4.4. *Method of operation*

Remove loose grit and clean the stone by brushing with water. Submerge the stone in the water-bath for 24 hours, or until the weight over a period of 24 hours does not increase by more than 0.1%.

Dry the stone using chamois leather until it leaves a dull surface. Weigh it (m_1) to an accuracy of 0.05%. Dry the stone in the oven to a constant weight (m_2), which is reached when the stone's weight over an interval of 24 hours does not reduce by more than 0.05%.

7.3.4.5. Calculation

Calculate the water absorption of the stone in percentage, rounded to 0.1%, using the formula:

$$c = \frac{m_1 - m_2}{m_2} * 100$$

where: c = water absorption at atmospheric pressure,
 m_1 = weight of a moist stone after absorption (g),
 m_2 = weight of a dry stone (g).

7.3.4.6. Report

The report contains the following:

- The water absorption at atmospheric pressure
- Reference to this specification
- A description of the stone and its weight
- Source of the stone
- Date of testing

7.3.5. Determination of the drop test breakage index

7.3.5.1. Subject and area of application

This method is used to determine the percentage of stone loss from heavy gradings of quarried stone in a standard drop test. This percentage is termed the Drop Test Breakage Index.

7.3.5.2. Sample for analysis

The sample contains at least 50 pieces taken at random from the ELCL weight of the grading class in question.

7.3.5.3. Equipment and other aids

- Suitable hydraulic grab (e.g. orange-peel type).
- Weighing equipment, accurate to within 2% of the lightest piece to be weighed.
- Bed of rocks of same grading as the sample to be tested.
- Sufficient volume of crushed rock aggregate to give a 0.5 m thick layer covering an area to support the bed of rocks.

7.3.5.4. *Execution*

Determine the individual weights of the rock sample prior to the test in accordance with Section 7.3.1. Prepare the bed of rocks by laying them out in a single compact layer on a 0.5 ± 0.05 m thick, layer of crushed rock aggregate. Subject each block in the test sample in turn to a drop of fall height $3 \text{ m} \pm 0.1 \text{ m}$ onto the bed of rocks. Record the result of each drop test. This record to include the number and type of visible flaws in each block, and the number and type of blocks resulting.

Remove the block, or broken parts thereof, from the bed of rocks. Set aside all resulting pieces with weight in excess of the ELCL weight, or of weight close to the ELCL weight, for further weighings. Clear all rock fragments from the bed of rocks, leaving clean surfaces prior to dropping the next block in the test sample.

Weigh individually, to an accuracy of 2%, each stone piece in the test sample heavier than the ELCL on completion of drop testing. Record the total weights in each weight fraction.

7.3.5.5. *Calculation*

Calculate the cumulative weight distribution curves for the sample prior to drop testing and after drop testing for all pieces heavier than the ELCL, and calculate the median sample weight before testing ($W50i$), and after testing ($W50f$), all in accordance with PW 7.3.1. Calculate the drop test breakage index, I_d , as: $I_d = [(W50i - W50f)/W50i] * 100\%$

7.3.5.6. *Report*

The following is included in the report:

- The Drop Test Breakage Index
- A reference to this specification
- A description of the sample, including its weight
- The source of the sample
- Date of test

The weight distributions before and after testing is provided on a single graph.

7.4 In-Surveys

At the inception of the works, the contractor to conduct a detailed multibeam echo sounder survey covering the scour protection length of A to B berth (from bollard 7 to bollard 33) and must be 30m offshore. The data may represent the seabed elevations as contour lines at 0.5m intervals.

This survey is carried out in collaboration with the *Supervisor*. The levels are approved by the *Supervisor*, before proceeding with the construction of the scour protection.

Levels are taken on a 3 m x 3 m grid and the levels are recorded to one decimal of a metre.

The results are recorded on a drawing to a scale of 1:1000, which is submitted to the *Supervisor*. This drawing, called the scour protection in-survey, forms the basis of calculations for measured quantities of the materials placed. Relevant features such as design depths, buoys, identification of ground survey control stations and quay numbers are shown on the drawing. The orientation (north point) is indicated together with the drawing scale. The datum to be used is Chart Datum Port (CDP), which is 0,9 m below MSL.

7.5 Out-Surveys

On completion of placing the stone layer, the *Contractor* carries out a survey of the scour protection. This survey is carried out in collaboration with the *Supervisor* who delegates staff to check the *Contractor's* work and to undertake spot checks as necessary.

The Contractor is required to undertake a dip survey of the scour protection to ensure compliance with the required tolerances. The stone levels are taken on a 3 m x 3 m grid and the levels are recorded to an accuracy of 50 mm. The Contractor is also required to undertake underwater video inspections of the scour protection.

The results are recorded on a drawing to a scale of 1:1000, which is submitted to the *Supervisor*. Relevant features such as design depths, buoys, identification of ground survey control stations and quay numbers are shown on the drawing. The orientation (north point) is indicated together with the drawing scale. The datum to be used is Chart Datum (Port), which is 0,7 m below MSL.

The out-surveys are used for checking tolerances only and do not form the basis for re-measurement.

7.6 Timing of Surveys

Surveys are carried out as follows:

- In-surveys: no more than two weeks before commencing placement of the scour protection in any area of the side slopes.
- Out-surveys: as soon as the relevant stone layer has been completed and the required tolerances have been achieved.



Compiled By:

A handwritten signature in blue ink, appearing to be "S. Gas", written over a horizontal line.

Signature

Name: Samukelo Gas

Designation: Engineer - Port of Durban

04/08/2022

Date

Reviewed By:

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04 August 2022

Date