



Black Watch Pass Rock Cut Stabilization

Bermuda

Annex C Specifications

Date: November, 2016



Part 1 GENERAL

1.1 Work Covered By Contract Documents

.1 Project Identification:

This project consists of the removal of loose and unstable rock fragments, rock pieces, rock blocks, rock masses, vegetation, soil and rock layers, by equipment and methods approved by the Owner's Representative from exposed bedrock surfaces in the Black Watch Pass Rock Cut area, Pembroke Parish, Bermuda to provide a stable and safe rock face.

.2 Project Location:

Black Watch Pass Rock Stabilization, Pembroke Parish, Bermuda.

.3 Project Owner:

Ministry of Public Works,
56 Church Street,
Hamilton, Bermuda, HM12.

.4 Project Engineer:

Ministry of Public Works,
Department of Works and Engineering
3rd Floor, 56 Church Street,
Hamilton, Bermuda, HM12.

1.2 Form of Contract

.1 Project will be constructed under the FIDIC Short Form of Contract First Edition 1999.

1.3 Work Sequence

.1 Contractor shall schedule the works coordinating all tasks and elements.

1.4 Contractor Use of Site

.1 Ascertain boundaries of Site within which work must be confined.

.2 Use of Site is to be coordinated through the Ministry of Public Works.

1.5 Drawings and Specifications Furnished

.1 Owner Responsibilities:



- .1 One electronic copy of drawings and specifications to Contractor.
- .2 Contractor Responsibilities:
 - .1 Pay for additional copies of drawings and specifications if required.
 - .2 Maintain at Site one complete set of up to date drawings and specifications. Make available to Engineer at any time.

1.6 Supplementary Drawings

- .1 Engineer may furnish supplementary drawings to assist proper execution of work. Such drawings will be issued for clarification only and will have same meaning and intent as if included with plans referred to in Contract Documents.

END OF SECTION



Part 1 GENERAL

1.1 Related Sections

- .1 Section 01010 – General Requirements

1.2 Requirements

- .1 Unit prices may be used to vary Contract Price when authorised by Owner's Representative.

1.3 Conditions of Unit Prices

- .1 Unit price quantities will be checked and measured by Owner's Representative.
- .2 Unit prices entered on Tender Form will remain in force until Substantial Completion and issuance of Interim Certificate of Completion.

1.4 Unit Prices

- .1 Mobilization / Demobilization - Lump Sum
 - .1 Terms and Payment: Lump Sum (LS).
 - .2 This Item includes: 50% of Lump Sum Contract Price for Mobilization and Demobilization to be paid when mobilization to site is complete. The remainder of the Lump Sum Price for Mobilization and Demobilization to be paid when work is complete and all materials, equipment and facilities are removed from site and site cleaned and left in condition to the satisfaction of the Owner's Representative and all other Agencies having Jurisdiction.
- .2 Rock Anchors - Unit Price
 - .1 Unit of Measurement: Install 25 mm diameter rock anchor (per m), and perform load test on each anchor.
 - .2 This item includes: The unit price for installation of each 25 mm diameter rock anchor including all labour, materials, equipment, and site access necessary to complete the work. The unit price also includes performing load tests on new rock anchors.
 - .3 The number of rock anchors specified in the specifications may change after scaling operations.
 - .4 The number of rock anchors to be load tested will be determined by the Owner's Representative.
 - .5 Rock anchors will be installed at locations designated by the Owner's Representative.



- .6 Payment for rock anchor installation and testing will be made at the Contract Unit Prices per rock anchor for 25 mm anchors and performing load testing which shall be full compensation for supplying all material, labour and equipment to execute the work as specified.
- .3 Rock Scaling - Unit Price
- .1 Unit of Measurement: Per square meter of area scaled
- .2 This item includes: Unit price per square meter area scaled
- .3 Payment for Scaling will be made at the Contract Unit Prices per square meter of area scaled, which shall be full compensation for supplying all material, labour and equipment to execute the work as specified.
- .4 Disposal and clean-up of materials from rock scaling, trimming, and excavation of existing fallen materials in the work areas is not part of this unit price.

END OF SECTION



Part 1 GENERAL

1.1 Utilities and Services

- .1 Existing Cables are known to exist within the site.
- .2 The Contractor is responsible for locating and protecting these and any possible other services within the works area.

1.2 Setting Out Stations

- .1 The Ministry of Public Works will establish sufficient survey stations for the Contractor to undertake the works.

1.3 Setting out and Dimensions

- .1 The Contractor shall be solely responsible for the accurate setting out of the works and shall employ a qualified surveyor whenever necessary. Any damages which may be incurred as a result of the incorrect setting out of the works shall be the responsibility of the Contractor.
- .2 The Contractor shall be responsible for the maintenance of all bench marks on the site.
- .3 The Contractor shall provide accurate locations for all rock anchors installed.

1.4 Use Of Site

- .1 Limit use of site to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated. Confine construction and operations to within the boundary shown on drawings.
- .2 Keep driveways and entrances serving all adjacent premises and public property clear and available to the public, owners, owners employees, guests, and both service and emergency vehicles at all times. These areas shall not be used for parking or storage of materials.

1.5 Working Hours

- .1 Normal working hours shall be Monday to Saturday 8.00am through to 6.00pm and Sunday working shall be permitted within the hours of 9.00am and 6.00pm.

END OF SECTION



Part 1 GENERAL

1.1 Required Submittals

- .1 The Contractor shall submit the following documents to the Engineers Representative:
 - .1 Schedule of Work
 - .2 Construction Method Statements
 - .3 Construction Safety and Health Risk Assessments
 - .4 Contractor Level 1 and level 3 IRATA certifications
 - .5 Environmental Method Statements
 - .6 Samples
 - .7 Certificates

1.2 Administration

- .1 Provide to the Engineer for review the submittals specified. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by the submittal until review is complete.
- .3 Review submittals prior to submission to the Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with the requirements of the Work and Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and will be considered rejected.
- .4 Verify that field measurements and affected adjacent Work are coordinated.
- .5 Contractor's responsibility for errors and omission in submission is not relieved by Engineer review of submittals.
- .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.
- .7 Keep one review copy of each submission on Site.

1.3 Schedule of Work

- .1 Prepare schedule in the form of a linked bar chart. All events, activities and constraints shall be numbered and shall be given a title. Details to be given for each event, activity



or constraint should include:

- .1 its title
 - .2 its scheduled start and finish dates
 - .3 its duration
 - .4 any relevant "must" start or finish dates
- .2 Provide a separate bar for each event, activity, operation or constraint, show proposed progress of all activities. Where applicable, indicate labour, construction crews, plant and equipment to be employed.
 - .3 The key milestones in the construction process shall also be identified. Schedule milestones will include but not be limited to the following:
 - .1 Start of construction
 - .2 Placement of orders for critical equipment items
 - .3 Delivery dates (to site) for critical equipment items
 - .4 Final handover (final completion)
 - .4 Revise and resubmit schedule every two weeks to reflect actual progress of the Works.
 - .5 With schedule updates, provide written explanations to Engineer as to why previously reviewed schedule is not being met (if applicable).
 - .6 Show changes in operations proposed (if required), to complete construction works within Contract Time.
 - .7 No progress payments will be approved until receipt of schedule updates acceptable to the Engineer.

1.4 Method Statements

- .1 Provide Method Statement for each key activity and additionally as requested by Engineer, to show construction methods, equipment and general methodology for carrying out the Work. Relate Method Statement to activities shown on Construction Schedule.
- .2 Method Statements shall identify, among other things:
 - .1 Sequencing of works
 - .2 Methods to ensure appropriate environmental protection
 - .3 Other key tasks as specified in the Contract Documents, and/or as requested by



the Engineer.

1.5 Certificates

- .1 Submit certificates of insurances within 10 days after award of Contract and before any work begins at the Site.

END OF SECTION



Part 1 GENERAL

1.1 Environmental Measures

- .1 Meet or exceed the requirements of all Bermuda environmental legislation and regulations, including all amendments up to project date provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

Part 2 EXECUTION

2.1 Fires

- .1 Fires and burning of rubbish on site will not be permitted.

2.2 Disposal of Rubbish and Waste Materials

- .1 Collect all rubbish and waste material and dispose of in accordance with the latest editions of the Ministry of Public Works Waste Management Plan.

2.3 Environmental Protection

- .1 When, in the opinion of Engineer, negligence of Contractor results in damage or destruction of local flora and or fauna, or other environmental or aesthetic features beyond work areas as shown on contract drawings, the Contractor shall be responsible, at his expense, for complete restoration including replacement to satisfaction of Engineer.

2.4 Pollution Control

- .1 Control emissions from equipment and plant to Bermuda authorities' emission requirements.
- .2 Prevent extraneous materials from contaminating air, land or water, by vacuum, temporary enclosures, screens, traps or other devices.
- .3 Spills of deleterious substances should be immediately contained and cleaned up in accordance with provincial regulatory requirements. Spills should be reported forthwith to the Engineer.

2.5 Storage And Handling Of Fuels And Dangerous Fluids

- .1 Locate fuel storage facility a minimum of 100 m from any water body in an area approved by the Engineer and construct impermeable dykes so that any spillage is contained.
- .2 Prevent spillage of gasoline, diesel fuel and other oil products into the water and on land. Clean up spills promptly at own cost in accordance with Bermuda regulatory requirements. Report any fuel spills immediately to Engineer.
- .3 Proper use of primers, grouts, bonding adhesives and other hazardous substances will



be undertaken to prevent their entry into the water. Substances are to be stored and mixed on protected surfaces away from site to prevent their entry into waterways and contamination of soils.

- .4 Collect and dispose of used oil filter cartridges and other products of equipment maintenance at industrial waste facility to satisfaction of Engineer.

END OF SECTION



Part 1 GENERAL

1.1 Related Sections

- .1 Section 01300 - Submittals

1.2 Description

- .1 This section outlines the requirements for the rock scaling, rock removal operations.

1.3 Definitions

- .1 **Scaling / Rock Removal:** Consists of the removal of loose and unstable rock fragments, rock pieces, rock blocks, rock masses, soil and rock layers, by equipment and methods approved by the Owner's Representative from exposed bedrock surfaces.
- .2 **Scaling Crew:** Experienced scaling crew consists of a supervising scaling foreman and a minimum of two (2) rock scalars.
- .3 **Manual Scaling/Removal:** Scaling consists of the removal of loose soil, rock, and overburden from behind the crest of the slope, the slope face, and benches on the slope. Scaling shall be done by hand working from a fall restraint or work positioning system (i.e. manlift or telescopic crane) and using suitable hand tools and powered equipment. Scaling also includes felling and removal of trees and brush, and pulling down larger rocks with wire rope attached to equipment on the road.
- .4 **Mechanical Scaling/Removal:** Mechanical Scaling consists of the removal of loose soil, rock, trees and bushes, on above or below the slope using a long-reach excavator with toothed bucket or with attached scaling chains.

1.4 Measurement Procedures

- .1 Scaling and rock removal will be measured based on the area scaled.
- .2 Payment for scaling and rock removal will be made at the Contract Unit Price per square meter, which shall be full compensation for supplying all material, labour, and equipment to execute the work as specified.
- .3 Protection of infrastructure shall be considered incidental to scaling and rock removal and all other unit price work items.
- .4 Repair or replacement of all infrastructure damaged by scaling and rock removal operations, to the satisfaction of the Owner's Representative, shall be at the Contractors cost.

1.5 Method of Measurement

- .1 Payment quantities shall be based on the 2D measurement of the square meter of area scaled. Area of scaling and rock removal to be paid for will be determined from the dimensions as per the project specifications. Irregularities in the rock face must be



accounted for in the quantities, as no additional measurement will be made for payment.

1.6 Basis of Payment

- .1 Payment for Scaling will be made at the Contract Unit Price per square meter covered for Scaling and Rock Removal and shall include full compensation for furnishing all labour, materials, tools, equipment, and incidentals for doing all the work involved in scaling and rock removal, as shown on the plans, as specified in the contract documents and as directed by Owner's Representative.

1.7 Action and Informational Submittals

- .1 Submit submittals in accordance with Section 01300 - Submittal Procedures.

1.8 Requirements

- .1 The Contractor shall provide an experienced scaling crew that consists of a supervising scaling foreman with at least three (3) years' experience, a minimum of two (2) rock scalers with at least two (2) years' experience each scaling on slopes similar to the project site conditions, within the last five (5) years. The scaling crew size shall be maintained at all times until the completion of all work.
- .2 In view of the rock slope heights at the project site, it has been assumed that scaling crews will be working from ropes at heights. Each scaling person working from ropes at heights must have a minimum of Level 1 Industrial Rope Access Trade Association (IRATA) training or approved equivalent. In addition, a Level 3 IRATA or approved equivalent supervisor must be onsite at all times.
- .3 Where scaling activities may impact upon any existing infrastructure the Contractor shall provide protective measures as detailed in the Contractor's Work Plan/Procedure, prior to commencing scaling. Protective measures shall include but not be limited to; padding material placed on the roadway, blasting mats, temporary rock berms or barriers, and temporary removal of signs, guardrail and similar infrastructure. The Contractor shall be completely responsible for all damage that is a result of its scaling or other operations.
- .4 The Contractor shall have hand tools and equipment available on site such that scaling can be carried out using the most appropriate and effective tools and methods for any given situation.

Part 2 PRODUCTS

2.1 Materials

- .1 None

2.2 Qualified Rock Stabilization Companies

- .1 The following list is a selection of potential Qualified Rock Stabilization Companies that may be able to assist with this work. This list is presented to assist the Bidders in



locating suitable sub-contractors. This list is not all inclusive and Bidders are not required to use any of these Companies. Other suitably qualified rock stabilization companies are welcome to be included in the Tender.

- .2 Potential Rock Stabilization Companies (alphabetical order);
 - .1 BAT Construction Ltd, 10230 Dallas Dr., Kamloops, British Columbia, Canada, 1-250-573-1222, <http://www.batconstruction.com/>
 - .2 Cimota Inc, 170 rue de Rotterdam, Saint-Augstin-de-Desmaures, Quebec, Canada, 1-418-878-3234, Patrick Girouz, pgiroux@cimota.qc.ca
<http://cimota.qc.ca/>
 - .3 GeoStabilization International, 543 31 Road, Grand Junction, Colorado, 81502 USA, 1-855-579-0536, <http://www.geostabilization.com/>
 - .4 Hi-Tech Rockfall Construction Inc, Forest Grove, Oregon, USA, 1-800-505-3155, <http://www.hitechrockfall.com/>

Part 3 EXECUTION

3.1 Scaling

- .1 Rock slope scaling and removal shall include the areas of the site identified on the site plans or on site by the Owner's Representative.
- .2 Thoroughly scale the rock slope to remove all loose soil, rock, and overburden from the slope face within 5 m of the crest of the slope.
- .3 All scaling operations must be completed from the top and proceeding downwards.
- .4 The Contractor is to assess the appropriateness of the methods in order to safely and effectively carry out the scaling and removal operations. Prior to initiation of the work, the Contractor must advise the Owner's Representative in writing, or otherwise agreed, of how the Contractor intends to complete operations and must obtain Owner's Representative approval.
- .5 Prior to proposing or initiating mechanical scaling operations, the rock slope (or area considered) must be manually scaled. If mechanical scaling is employed, manually scale the slope afterwards to remove any remaining loose material. Areas proposed for mechanical scaling must be approved by Owner's Representative.
- .6 On slopes that require both scaling and anchoring, complete the scaling operation in a particular area prior to rock anchoring in that same area unless otherwise directed by the Owner's Representative.
- .7 All scaling and removal operations are to be conducted under full time inspection of Owner's Representative and completed to the satisfaction of the Owner's Representative. The extent of scaling and removal in all areas and suitability of equipment being used will require the approval of Owner's Representative.



- .8 The Contractor shall be responsible for public safety during scaling operations. One lane of traffic must remain open at all times.
- .9 Scaled material is considered waste material and must be disposed of offsite in accordance with applicable regulations. Disposal of the scaled materials shall be carried out by Others.
- .10 Comply with all safety requirements during the scaling operation.
- .11 Notify Owner's Representative 48 hours prior to scaling operations for inspection of scaled work surface. Owner's Representative may request the Contractor to do further work which the Owner's Representative deems necessary.

3.2 Protection

- .1 Work in coordination and cooperation with Others to prevent damage to surroundings and injury to persons.
- .2 Repair or replacement of all infrastructure wilfully damaged by scaling operations, to the satisfaction of the Owner's Representative, shall be at the Contractors cost.

END OF SECTION



Part 1 GENERAL

1.1 Related Sections

- .1 Section 02270 – Rock Scaling

1.2 Description

- .1 None.

1.3 Method of Measurement

- .1 None.

1.4 Basis of Payment

- .1 None.

Part 2 PRODUCTS

2.1 Materials

- .1 Not used

Part 3 EXECUTION

3.1 General

- .1 Talus and debris material accumulated on the rock slope and along the toe of the slope shall be removed by Others.

END OF SECTION



Part 1 GENERAL

1.1 Related Sections

- .1 Section 01010 – General Requirements
- .2 Section 01300 - Submittals
- .3 Section 02270 – Slope Protection and Erosion Control

1.2 REFERENCES

- .1 Prestressed Rock and Soil Anchors by the Post-Tensioning Institute (PTI), 2014.

1.3 DESCRIPTION

- .1 This section outlines the requirements for the provision and installation of rock anchors.
- .2 Rock anchors may be installed in areas identified in the field by the Owner's Representative following scaling activities.
- .3 The number of rock anchors required will depend upon the conditions encountered and the conditions of the rock slope following scaling. There are no assurances regarding the actual number of rock anchors to be used for this project – i.e. the final number of rock anchors may vary from zero (0) to fifty (50).

1.4 MEASUREMENT PROCEDURES

- .1 See Instruction to Bidders.
- .2 Payment quantities shall be determined as per project specifications. Quantities of rock anchors to be paid for will be based on the number of anchors installed and associated lengths.

1.5 BASIS OF PAYMENT

- .1 The contract price paid per rock anchor shall include full compensation for furnishing all labour, materials, tools, equipment, and incidentals, and for doing all the work involved in furnishing and placing rock anchors, complete in place, as shown on the plans, as specified in the contract documents and as directed by the Owner's Representative.

1.6 SUBMITTALS

- .1 Submit in accordance with Section 01300 Submittals.
- .2 The Contractor shall submit a detailed method statement for controlling and monitoring the drilling angle and alignment of anchors before commencing anchor installation.
- .3 Rock Anchor Installation Procedure: Prior to ordering Rock Anchor materials, the Contractor shall submit a Rock Anchor Installation Procedure for review by the Project



Manager. The Installation Procedure shall include product information from the anchor hardware and grout manufacturers including their recommended installation procedures, drilling equipment and hole diameter, grouting and tensioning procedures, calibration certificate(s) for rock anchor testing equipment, and similar information.

- .4 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for rock anchors and include product characteristics, performance criteria, physical size, finish and limitations.
- .5 Maintain field drilling records for each rock anchor, including date/time, location of bedrock, overall drilling conditions making specific notes on any weathered or water zones encountered, drilled length of tie-back and rock embedded length.
- .6 Maintain grout installation records for each rock anchor, including, date/time, amount of grout used and Specific Gravity of each grout batch.
- .7 Provide Owner's Representative with a daily copy of field records.

Part 2 PRODUCTS

2.1 MATERIALS

- .1 Anchors shall be 25 mm diameter, grade 1030 MPa, with all accessories (caps, centralizers, couplers, bearing plates, wedge washers, nuts, etc.) required to complete the work as detailed on the plans and to the manufacturer's specifications.
- .2 Anchor lengths and design loads will vary depending upon the site conditions and the anchor requirements noted following scaling operations. Rock anchors may consist of the following lengths: 3 m and 6m.
- .3 Each rock anchor shall have a 200 mm by 200 mm by 25 mm galvanized face plate, galvanized bevelled hardened steel washers (minimum 2 per anchor) and a galvanized hexagonal nut.
- .4 Rock anchor installations will utilize grout consisting of a non-expansive, non-shrink grout. Grout shall have a minimum compressive strength of 35 MPa at 3 days and 50 MPa at 28 days. The grout shall have non-shrink properties.
- .5 The anchor shall be provided with Class I, encapsulated tendon, double corrosion protection according to the recommendation for Prestressed Rock and Soil Anchors publication.
- .6 The rock anchor shall be a two-stage grouted anchor with the free length of the anchor fully grouted after tensioning and lock-off. PVC or other bond breakers on the free length shall not be permitted.
- .7 Each item of the rock anchor system shall be Hot-Dip Galvanized conforming to ASTM A123 or ASTM A153 wherever applicable.



Part 3 EXECUTION

3.1 EXAMINATION

- .1 Visually inspect substrate in presence of Owner's Representative.
- .2 Inform Owner's Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and receipt of written approval to proceed from Owner's Representative.

3.2 INSTALLATION

- .1 Anchor hole drilling, anchor installation, grouting, pre-stressing and related activities shall be carried out only under the supervision of experienced geotechnical personnel.
- .2 Procedures and equipment used for drilling holes in rock, preparing, installing, grouting, and tensioning rock anchors shall be in strict accordance with the manufacturer's specifications to ensure the required design anchorage is achieved.
- .3 Discrepancies between the manufacturer's specifications and those presented within this specification should be reviewed and approved by the Owner's Representative.
- .4 Provide appropriate drilling platform or equivalent for drilling, installation, and testing of rock anchors on the slopes.
- .5 Anchor the drilling platform adequately to ensure the safety of the workmen and the satisfactory performance of the work during the drilling, installation, and testing of the rock anchors.
- .6 Where required, prepare the rock surface for uniform loading from the bearing plate during post tensioning.
- .7 Anchor hole diameters shall be minimum of 100 mm, or as per manufacture specifications.
- .8 Rock anchors shall be installed with sufficient thread exposed to accept a plate and nut to facilitate tensioning and testing.
- .9 Temporary casing should be provided as required to stabilize drill hole sidewalls.
- .10 Use commercially manufactured centralizers at intervals not greater than 3 meters to keep the bar centred in the hole. Ensure centralizers do not interfere with tremie tube and are sized appropriately for anchor diameters.
- .11 Anchor holes shall be grouted within 48 hours of the hole being drilled.
- .12 Anchor hole depth shall be approved by Owner's Representative before anchor installation.
- .13 Couplers (if required) shall be installed in a manner which will ensure that they can transfer the required anchor loads.



- .14 Grout shall be tremied into the lowest elevation of the anchor hole without interruption.
- .15 Grout sampling and testing will be carried out by a certified testing consultant appointed by Owner's Representative.
- .16 After grout is cured to at least 35 MPa, anchors shall be tension tested and locked off in accordance with the Post Tensioning Institute (PTI 2014) method for proof testing rock anchors. Performance load tests as per PTI will be performed on select new and existing anchors, as per Owner's Representative direction. Design loads and lock off loads are as shown on the drawings.
- .17 The rock anchor shall be a two-stage grouted anchor with the free length of the anchor fully grouted after tensioning and lock-off.
- .18 In order to confirm the anchorage methods, products, and procedures proposed by the contractor, the Contractor at his expense shall supply all equipment and assist the Owner's Representative conduct rock anchor pull 'performance testing' on the first three rock anchors and a minimum of 3% of the remaining rock anchors in accordance with the Post Tensioning Institute (PTI 2014) Standard Methods. Additional performance testing will be requested at the discretion of Owner's Representative if any rock anchors do not pass testing requirements.
- .19 All other rock anchors shall be pull 'proof' tested, after grout is cured at least 35 MPA, anchors shall be tension tested and locked off in accordance with PTI method for proof testing rock anchors. Design loads and lock off loads are as per project specifications
- .20 Failed rock anchors shall be removed and reinstalled by the contractor at his expense.

3.3 DEFECTIVE ROCK ANCHORS

- .1 If rock anchors are deemed to be defective by the Owner's Representative then contractor must remediate and reinstall anchors at own cost with methods approved in writing from Project Manager.

END OF SECTION