

SECTION 5B - TECHNICAL SPECIFICATIONS

INDEX

INTRODUCTION	3
CONSTRUCTION NUMBERING SYSTEM	4
1.1.0 SUMMARY OF WORK, PROJECT SCOPE & LIMITS	5
1.1.2 ACCESS TO THE SITE	11
1.5.6 TEMPORARY WORK BARRIERS	12
2.2.0 SITE INSPECTION	14
2.2.2.A SELECTIVE SITE DEMOLITION – CUTTING OF CONCRETE OR ASPHALT PAVEMENTS ATTACHED TO WALL	14
2.2.2.B SELECTIVE DEMOLITION, REMOVAL OF CONCRETE SKYLIGHTS	16
2.2.2C CONCRETE STRUCTURE OVER MUSEUM ROOF.....	18
NO WORKS ARE INCLUDED FOR THIS STRUCTURE	18
2.2.2D SITE DEBRIS	18
2.2.4 REMOVAL OF METAL FIXTURES.....	20
2.2.8 GRADE ADJUSTMENT TO DRAIN.....	21
2.3.1 EXCAVATION, FILLING & BACKFILLING	22
2.6.2 SITE DRAINAGE	23
2.6.2.B SURFACE DRAINAGE	27
2.6.2.C DRAINAGE ON TOP OF WALLS – EARTH SURFACES.....	28
2.6.2.D DRAINAGE ON TOP OF WALLS – COVERED SURFACES.....	29
2.8.2 INSTALLATION OF SAFETY FENCE	30
2.9.0 SITE PLANTS/VEGETATION	32
2.9.5 SITE ENCROACHMENT.....	32
03 DIVISION - GROUTING.....	34
3.6.4 INJECTION GROUTING LARGE CRACKS	34
04 DIVISION - MASONRY.....	36
4.0.6 LIME (HYDRAULIC) MORTAR CHARACTERISTICS.....	36
4.4.3A INSTALLATION OF NEW ASHLAR STONE AT BASE OF WALLS	39
There are several locations at the base of the Walls where the ashlar are completely missing either due to erosion and disintegration of lower courses, which then resulted in the collapse of upper courses or other actions. These are necessary for the stability and strength of the walls and must be rebuilt.	39
4.4.3B INSTALLATION OF NEW ASHLAR STONE AT EMBRASURES, WALLS AND PARAPETS.....	41
4.9.0 PLANT REMOVAL FROM MASONRY WALLS.....	43
4.9.2A MORTAR POINTING	44
4.9.2.B STRUCTURAL CONSOLIDATION – COLLAPSED RETAINING WALL AT NORTHEAST GUN PLATFORM	48
4.9.2.C STRUCTURAL CONSOLIDATION – DEFORMED CAVALIER WALL	50
4.9.2.D STRUCTURAL CONSOLIDATION – COLLAPSED PARAPET SOUTHERN CURTAIN WALL.....	51
4.9.2.E STRUCTURAL CONSOLIDATION OF SOUTH CURTAIN WALL	53
4.9.5 STONE CLEANING - GENERAL	54
4.9.6 REPAIR OF STONE BUILT PLATFORMS & FLOORS.....	56
05 DIVISION - METALS	58
5.1.1 SAFETY FENCE	58
5.1.2 SAFETY BARS.....	59
5.1.3 SAFETY HANDRAILS.....	60
06 DIVISION - WOOD	62
6.1.1 WOODEN BLOCKS	62

6.1.2 WOODEN SAFETY BARS.....62

07 DIVISION – MOISTURE PROTECTION64

7.0.5 DRAINAGE SYSTEM AT THE BOTTOM OF THE MONUMENT64

7.0.6 DRAINAGE SYSTEM’S SCUPPERS AND DRAIN PIPES67

8.6.3 SKYLIGHTS.....70

09 DIVISION - FINISHES71

NOT USED71

10 DIVISION - SPECIALITIES72

10.4.5 VISITOR INFORMATION PANEL.....72

11 DIVISION - EQUIPMENT.....73

NOT USED73

12 DIVISION - FURNISHINGS73

NOT USED73

13 DIVISION - SPECIAL CONSTRUCTION73

NOT USED73

14 DIVISION - SCAFFOLDING73

14.8.0 SCAFFOLDING.....73

15 DIVISION - MECHANICAL74

NOT USED74

16 DIVISION - ELECTRICAL74

16.4.0 ELECTRICAL CABLES ON MASONRY.....74

16.5.3 EMERGENCY LIGHTING.....74

INTRODUCTION

These TECHNICAL SPECIFICATIONS, are for execution of conservation intervention works. This document is designed to guide the conservation works at the Bastion. These specifications must be used in combination with the Bill of Quantities; Drawings and Details; along with other parts of this volume.

This section covers the implementation action and interventions instructions and contains detailed written instructions that accompany the Drawings & Bill of Quantities to describe and specify in detail the work and procedures to be carried out. It is also to be used for bidding for those who may respond to a tender offer and for the ENGINEER who will oversee the work.

It is divided, in general, by trades and written in the common three part format: PART 1---GENERAL, PART 2 – MATERIALS (for overall materials refer also to MATERIALS & EQUIPMENT) and PART 3 – EXECUTION. The specifications are written in the technical, standard 3-part format in order to create uniformity across all activities. In cases where local practice overrides these specifications then it is up to the discretion and prudence of the ENGINEER in the field or the UNDP office. Not every situation can be foreseen but these specifications give an outline to the work and set a standard that is to be met. These Technical Specifications (implementation and interventions) **are ordered as per common conservation trades** involved and generally work toward the larger scope to smaller details. They are, as in all complex conservation projects, interconnected and refer to one another as well as the Drawings describing the work and all manufacturer's data sheets.

It is the responsibility of the contractor carrying out the conservation works to request clarification to this, or any subsequent document, to the ENGINEER should there be any questions or misinterpretation.

LOCALLY AVAILABLE SIZES FOR ALL ELEMENTS DESCRIBED IN THIS DOCUMENT CAN BE USED WITH THE PERMISSION OF THE ENGINEER. THESE DOCUMENTS ARE INTENDED GIVE AN OUTLINE AND STANDARD OF THE WORK TO BE PERFORMED

ANY OMISSIONS or DIFFERENCES BETWEEN NOMINAL vs. DIMENSIONAL SIZES SHALL NOT BE TAKEN ADVANTAGE OF TO INCREASE PRICE.

ALL MATERIALS, SIZES AND INSTALLATION LISTED IN THE DRAWINGS AND SPECIFICATIONS MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL.

CONSTRUCTION NUMBERING SYSTEM

This Technical Specification utilizes the Construction Specification Institute's numbering system. It is divided into 16 Divisions for the various trades involved and necessary for the conservation works. It is sequential; however, NOT all numbers are used as it is a modular system. This allows sections to be inserted (or removed) at various times without changing the sequence of numbers. It also allows standardization within and across the project. The numbers used in this project are the same numbers used in the drawings for keynotes as well as the Bill of Quantities. The Divisions are listed below to assist the contracted party. ANY QUESTIONS MUST BE SUBMITTED IN WRITING TO THE ENGINEER.

There are three "angles" from which to describe the required work interventions -Text in these Technical Specifications, Drawings and the Bill of Quantities. These three angles must be connected to give the best description possible. These together will tie together the different aspects necessary for this intervention project.

These divisions also generally align with a project schedule beginning with General and Site Conditions and include Masonry, Windows and moving toward Finishes.

- Division 01 — General Requirements
- Division 02 — Site Construction
- Division 03 — Grouting
- Division 04 — Masonry
- Division 05 — Metals
- Division 06 — Wood
- Division 07 — Thermal and Moisture Protection / Roof
- Division 08 — Doors and Windows
- Division 09 — Finishes
- Division 10 — Specialties
- Division 11 — Equipment
- Division 12 — Furnishings
- Division 13 — Special Construction
- Division 14 — Scaffolding
- Division 15 — Mechanical
- Division 16 — Electrical

01 DIVISION – GENERAL REQUIREMENTS

1.1.0 SUMMARY OF WORK, PROJECT SCOPE & LIMITS

PART 1---GENERAL SUMMARY

The physical limitations of the scope are as follows. It includes the entire bastion from the Arsenal Gate at the north, including the round bastion tower to the Ditch to the south and west to the stairs and on top of the rampart walls including the Cavalier and its walls. From the bottom of the ditch to the top of the ramparts and Walls.

It does NOT include the lighthouse and the Museum. However should there need to be access to the top of the ramparts for any work, or to provide protective works and equipment inside the Museum for health and safety, then it may be possible to enter through the museum with the appropriate permissions.

The scope is divided into two parts:

1) Conservation - to address structural and material issues

This includes the structural elements such as grouting fissures, replacement stone, building lost stones and drainage. It also includes replacing the failing concrete caps over the skylights, vegetation removal and cleaning of all stains.

2) Functional space - to improve the usability of the space on top of the ramparts.

This includes the restoration of paving surfaces on top of the Cavalier, electrical conduit, visitor safety features such as guardrails, didactics, and limited lighting. All of these measures are outlined graphically in the Drawings and financially in the Bill of Quantities. The Bill of Quantities includes a column that outlines each quantity. By separating these elements it will allow the UNDP office to prioritize the intervention and select elements for works that are deemed essential.

This includes ALL structural stone work in walls and other elements as outlined in this document and the Drawings.

NOTE: IF THERE ARE ANY ELEMENTS THAT CAUSE STRUCTURAL INSTABILITY THAT ARE UNCOVERED OR OBSERVED DURING THE WORKS THEN THESE ARE ALSO INCLUDED IN THE SCOPE OF WORK.

If these areas are found then they must be brought to the immediate attention of the ENGINEER.

It is the privilege of the ENGINEER empowered by UNDP to establish the schedule and order of the works. Therefore the drawings contain details concerning several walls and arches that must be stabilized and structurally consolidated BEFORE other works commence. It is also essential that protective fencing is provided as outlined in the drawings before other works commence.

However, these priorities do not infringe on the staging and other works that can be prepared off-site or in conjunction with these important factors. It is the responsibility of the contracted party to conduct the works in the most efficient, cost effective and time saving manner.

ARCHAEOLOGICAL SITE

The Bastion is an archaeological site therefore the utmost care must be taken in working at the site. There are or may be found decorative building elements, stone or iron cannon balls, iron cannons and other such elements on site. These must be collected before any works on the site begin as per the instructions of the ENGINEER.

CAUTION: IF ANY DECORATIVE ELEMENTS ARE FOUND DURING THE WORKS UNDER THE SURFACE THE WORK IN THE IMMEDIATE VICINITY MUST BE IMMEDIATELY HALTED AND THE ENGINEER NOTIFIED IMMEDIATELY.

Any element(s) discovered must be protected and if possible left in place for the removal by an approved archaeologist.

Description of work

DESCRIPTION OF THE WORK

The intent of these documents along with other investigations and preliminary reports is to describe the work that the contractor will undertake. The contractor shall perform all of the work specified here in these documents in good faith and execute the contract and such additional, extra, collateral and incidental work as required and necessary for the proper execution and completion of the work reasonably inferable from the contract. Contractor shall provide and pay for all labor, materials, equipment, tools, temporary water, light, power, transportation, shop plans, working drawings and incidentals and other facilities and services necessary for proper execution and completion of the work, whether or not they are incorporated into the work.

SCOPE OF DRAWINGS AND SPECIFICATIONS

The specifications and drawings are NOT intended to cover every detail of materials, parts, tools, equipment or construction necessary to properly complete the work but to define the scope and outline the works. The contractor shall furnish all materials, parts, tools, equipment and labor necessary for the proper execution and completion of the work, whether or not said details are particularly shown or specified in the drawings and specifications, all at no additional cost to UNDP. The contractor shall provide any material shown on the drawings but not specified in the specifications, or any material specified in the specifications but not shown on the drawings, as though it were both shown and specified – this is also applicable to the Bill of Quantities and Drawings.

DISCREPANCIES

Before the contractor begins ANY work they shall carefully review the ALL documents, drawings and specifications, inspect the site, and compare the documents comprising the contract with each other and with any additional information furnished by UNDP with the objective of discovering any errors, inconsistencies or omissions. Should any of the above-described errors, discrepancies or omissions be found in the contract or should any discrepancy be found between the contract and the physical conditions at the site or in any subsequent drawings or addenda that may be provided thereafter, the contractor shall notify the UNDP in writing, immediately. Any work done after such discovery, unless authorized in writing by UNDP will be done at the contractor's expense. The contractor will not be allowed to take advantage of any error, omission or discrepancy in the contract.

SITE CONDITIONS

Times of operation are from 8am in the morning until 6pm at night. Access gates at the ramp entrance (further to the west) must be kept locked at all times not in use. Since the ramp is away from the construction site, the ramparts must be fenced out along the perimeter of the construction site to prevent access by public. The stair must be closed off to prevent access by the public. The Museum doors to the roof, the one facing the west and the second facing the south, should always kept closed and prevent any access of public to the construction site.

Access to site - Contractor shall coordinate with UNDP to obtain procedures for gaining access to the site, erecting offices and toilet facilities, gate and access to the monument.

Permitted Entry - The contractor, and any of its officers, employees, agents and subcontractors shall be permitted to enter upon any part of the site in connection with the performance of the work hereunder, subject to the terms and conditions contained herein. A detailed list of all personnel must be submitted to UNDP of all persons visiting or working on the site. Should access to the monument via the Museum be required a written letter to the Engineer must be submitted.

Degree of Care - The contractor, employees, agents and subcontractors shall use the highest degree of care when entering and working on the site. The contractor shall comply with, and shall all involved to comply with, any and all local laws, ordinances, permits and the contract in respect to its operations on the site. Contractor shall not unreasonably encumber the site with materials or equipment.

Damage - If the contractor or any of its employees causes damage to the property, the contractor must, immediately notify UNDP or their agent and either (a) pay the cost of repair of such damage or (b) repair or replace the property so damaged.

UNKNOWN CONDITIONS

If conditions at the site differ materially from those indicated in the specifications or drawings that could not have been known to the contractor at the time the bid submitted, and cause a material increase or decrease in the contractor's cost of, or time required for, the performance of any part of the work, an equitable adjustment in the contract amount or contract time or both may be made in the form of a change order or contract modification according to the contract.

INSPECTION

The contractor is required to inspect the site **at their own cost** and to examine and become familiar with the SITE, scope of work, the Drawings and Specifications, and all other documents including preliminary studies pertaining to the work. The submission of the bid by the contractor shall be sufficient to establish the presumption that the contractor has investigated the site and is satisfied as to all conditions to be encountered, the quantity and quality of the work to be performed and all matters to be furnished for the completion of the work.

OWNERSHIP OF DRAWINGS AND SPECIFICATIONS

All documents required to perform the work are the property of UNDP. This includes all shop drawings and subsequent submissions required to carry out the work. ALL drawings, including signed copies, are required to be returned to UNDP upon completion of the work.

PERMISSIONS & PERMITS

Wherever the work requires obtaining of permits from any public authority, the contractor shall furnish, **at their own cost these permits** with copies to the ENGINEER. NO WORK SHALL PROCEED BEFORE SUCH PERMITS ARE OBTAINED.

STORAGE OF MATERIALS

Only such materials and equipment as are necessary for the works shall be placed, stored, or allowed to occupy any space at the site of the work. All materials stored at the site shall be stored in a manner that precludes any safety or health risk.

FIELD MEASUREMENTS / INSPECTIONS

The contractor is responsible for all fitting and inspection of the work and shall take complete field measurements affecting all works in the contract and shall do all cutting, patching, or fitting of work that may be required to make the several parts of this contract and existing work come together and fit properly.

WORK STOPPAGE IN THE CASE OF DOUBT

Should the contractor find any discrepancy, omission, violation of applicable codes, or is in doubt as to the meaning of the contract, the contractor shall stop the work in

progress, if that work is affected by the particular discrepancy, omission or violation, and consult with the

COMPLETION

Upon completion and before final acceptance of the work, the contractor shall remove from the site and adjacent premises all machinery, equipment, surplus materials, and useless materials, rubbish, temporary buildings, barricades and signs, and shall restore the site to an acceptable appearance deemed by the ENGINEER as **an essential part of the project**.

STANDARDS OF PERFORMANCE

GENERAL STANDARDS

Degree of Skill, Care and Diligence. The contractor shall perform, or cause to be performed, all of the work required of it under the terms and conditions of the contract with that degree of skill, care, and diligence normally exercised in performing that type of work in projects of a scope and magnitude comparable to the project, to the reasonable satisfaction of the ENGINEER. The contractor shall use their best efforts to assure timely and satisfactory completion of the work and shall, at all times, act in the best interests of UNDP. The contractor shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the work under the contract, unless the contract gives other specific instructions concerning those matters.

The contractor has an obligation when directed by the ENGINEER, shall promptly correct or remove all work identified to be defective or incomplete. The contractor shall bear all costs. If the contractor does not proceed with the correction or removal of such defective work after written notice from the ENGINEER may authorize corrections by other means in order to correct, remove or repair defective work. Unauthorized work done without permission from the ENGINEER as shown on the drawings or specifications will be considered as unauthorized.

MATERIALS

There will be no substitutions of materials on this project. The materials shall comply with the specifications and used throughout the work. In the absence of a defined specification then the contractor will submit in writing a report of any required new materials.

Testing of all materials including mortar, stone, sand and other materials shall be conducted and approved by the ENGINEER. All data sheets and materials identification and literature including product description, samples and test along with the name of the manufacturer will be submitted to the ENGINEER.

The ENGINEER shall have the right to inspect any and all materials used to ensure quality and standards.

1.1.2 ACCESS TO THE SITE

PART 1---GENERAL SUMMARY

Coordination with the local authorities is required as some areas may require temporary road closures including the bastion tower to the east and near the museum entrance at the north, the Fosse since the municipality is carrying works at the area and the east Cavalier's façade due to the existing restaurants.

Access to the site is from several locations:

- 1) The base of the Bastion tower and curtain wall to the south is from the ditch. Currently there are new works in the ditch and these must be protected.
- 2) The base of the North side curtain walls is from the Arsenal Gate, road and parking lot.
- 3) Access to the top of the ramparts is via a vehicular access is from an unpaved ramp to the west
- 4) Pedestrian access is via a narrow, unprotected stair to the north. This must be used with caution. There is also access to the top of the Bastion tower from inside the Museum but this may not be available.
- 5) Access to the top of the Bastion Tower is difficult as it is blocked by the museum roof. Temporary stair scaffolding may need to be erected to cross over the museum roof, extending from the ramparts to the Tower's roof.
- 6) Access to the curtain wall to the East is difficult due to the two existing restaurants erected directly against the wall. Coordination with the local authorities and restaurant owners is required.

As the site is accessible from below and above measures must be taken to secure the site during the works and after work hours. There are currently gates at the ramps leading into the interior but these are easy to climb. There are also bollards at the ramp leading to the roof but these have been removed.

1.5.6 TEMPORARY WORK BARRIERS

PART 1---GENERAL SUMMARY

Temporary barriers are required to be erected in several areas:

- 1) At the pedestrian stair that accesses the top of the ramparts. This is to prevent people from ascending to the top during the works.
- 2) Around the tombs, trees at the archaeological area on top of the ramparts. This is to protect any archaeological remains even if outside the scope of these works.
- 3) Around all work areas. These can be moved as work progresses along the base of the Bastion wall **reducing the amount of fencing required**. Alternatively these could be erected across the entire entry to the ditch along the south side of the Bastion to protect the whole face of the project. These must be of sufficient distance from the work areas for safety. The areas of the Bastion are not in good condition so extreme care must still be taken. Any injury or damage is to be reported immediately to the ENGINEER.
- 4) Anywhere along the top of the bastion and at the base where works are progressing for safety.
- 5) At the vehicular entry ramp to the west of the Bastion. To prevent unauthorized people or vehicles from accessing the top of the bastion. This includes around any temporary work areas. The barrier can be put on top of the walls as close to the project as required to allow access related to the works and prevent any other unauthorized access.

All areas must have GATES which are LOCKABLE TO CONTROL ACCESS.

SUBMITTALS – submit samples and manuf. data of fences to ENGINEER for approval before erecting fencing. Submit plan for all fences to the Engineer for approval.

STANDARDS – all fencing will comply with EuroNorm, i.e. EN 10223-4:2012, EN 10223-6:2012,

PART 2 – MATERIALS

1.5m high chain link fence system, galvanized, self-supporting, precast concrete pads to support fencing; durable, weatherproof sign materials

- a. Temporary fencing to site facilities
- b. New double Chain / Link gates
- c. Temporary Barriers
- d. Plastic warning signs

PART 3 – EXECUTION

- 1) Design location of fences and gates and submit to Engineer for approval

- 2) Install fence and lockable gates at the entry to the site as outlined above. Keep locked at all times. Give a copy of the key to the site engineer.
- 3) Before commencing any works on site temporary barriers must be erected **as required to perform the work.**
- 4) Place signs warning that these areas are off limits during the works in Turkish, Greek and English in obvious locations. Maintain the barriers throughout the project.
- 5) Remove all barriers, supports and signs at the end of the project and repair any surface affected.

02 DIVISION – SITE CONSTRUCTION

2.2.0 SITE INSPECTION

PART 1---GENERAL SUMMARY

The Bastion is an archaeological site therefore the utmost care must be taken in working at the site. Therefore the site must be inspected and if any elements are found they must be brought to the attention of the ENGINEER and UNDP. They are not to be moved without permission.

Any element(s) discovered must be protected and if possible left in place for the removal by an approved archaeologist appointed by the responsible authorities. In the cases where there is subsurface work planned for drainage the chances of finding archaeological elements are not expected as the work occurs in fill material where archaeological investigations have already taken place, nonetheless utmost care should be taken with any subsurface work since there is always a chance of an important element to be found.

SUBMITTALS – Digital images of all found objects, a site plan of where the element was located and an index with descriptions of all elements is to be submitted to the ENGINEER and UNDP office.

PART 2 – MATERIALS

Digital camera, plan of site, inventory of elements found

PART 3 – EXECUTION

The area to be inspected includes the entire length of Bastion from the Ditch, the interior, exterior and wall tops and sides. Everything included within the limits of the Study and the boundaries of the construction site.

The contractor is to **review the site** before any work begins making notes on a site plan of all elements if required. **Photographs are to be taken if any elements are found** on the surface and a short written description is to be provided. The elements are then to be left in place and the ENGINEER notified in writing.

2.2.2.A SELECTIVE SITE DEMOLITION – CUTTING OF CONCRETE OR ASPHALT PAVEMENTS ATTACHED TO WALL

PART 1---GENERAL SUMMARY

This section includes the selective removal and subsequent disposal of areas of Portland cement concrete or stone and asphalt pavements along the base of the Bastion. Hard impermeable surface pavements such as concrete, stone and asphalt pavements prevent water from evaporating from below. These hard surfaces force moisture up into the more porous walls where it then evaporates and damages the stones and then the walls. However these surfaces provide usable access spaces for people and disabled persons. These slabs are also at various heights. Therefore only

limited portions of these slabs will be removed as indicated on the drawings to permit water to evaporate before contacting the walls.

The extent of the demolition work is indicated on the drawings. Before any demolition begins the permission and observation of the ENGINEER is required and an inspection must be conducted. Therefore this section outlines the instructions for the removal of these elements.

SUBMITTALS - Submit photographs of the areas before, during and after the demolition along with a report detailing the progress of the work. If anything is found below the pavements, stop work immediately and notify the ENGINEER.

STANDARDS: EuroNorm standards relevant to aggregates such as EN12620, EN13043, EN13139 etc., the EN 1997 for geotechnical design and the relevant EN for testing these materials and their compaction

PART 2 – MATERIALS

TOOLS – only hand power tools are permitted to cut and remove the Portland cement concrete and asphalt slabs. Work must progress slowly with hand cart, shovels, picks and buckets are other tools. Small electrical equipment such as buzz-saw or cut off saw may be used with caution to obtain smooth and straight line cuts. Additionally small compacting tools may be used to obtain compaction. Debris resulting from the removal of these elements must be removed from the site using small vehicles. Large trucks are not permitted on site or inside the Bastion. Utmost care must be taken with using the electrical equipment and vehicles.

PART 3 – EXECUTION

- 1) ALL areas for removal must be clearly marked on site with chalk before commencing work.
- 2) The contractor must check with local authorities for any services that may have been installed in the pavements close to the walls and may be affected by these works. He must submit to the Engineer any such information as well as the measures he will take to avoid any problems with these services.
- 3) The clear width of the finished gravel covered trench shall be minimum 250mm
- 4) The areas must be inspected and approved by the ENGINEER BEFORE any work begins.
- 5) The areas are then to be neatly saw-cut along the line approved by the ENGINEER. This saw cut will be NEAT, straight and parallel to the adjacent wall. AVOID OVER CUTTING AT CORNERS THAT WILL WEAKEN THE PAVEMENT.
- 6) The concrete, stone and/or asphalt is then to be carefully removed beginning at the saw cut taking care not to damage the pavement that is to remain or the historic stone ashlar walls.

CAUTION: UTMOST CARE MUST BE TAKEN NEAR THE STONE WALLS WHEN REMOVING PORTLAND CEMENT CONCRETE OR ASPHALT SLAB. ONLY HAND TOOLS PERMITTED NEAR STONE WALLS

- 7) Provide protective measures such as temporary yellow and black tape barricades and other forms of protection as required for safety and security in and around the areas being removed. Protect historic stone walls and nearby stones. The work is to be performed in safe and systematic manner. Use such methods as required to complete work indicated on the drawings and minimize disturbance. Demolish existing elements only as indicated on the drawings and with the supervision and inspection of the ENGINEER. Workers must wear proper personal protective equipment at all times. Adhere to the Health & Safety plan.
- 8) All removal will be conducted by small power hand tools. No large machines or power tools are to be used near the existing stone walls.
- 9) Extreme care must be taken not to penetrate too deep during removal Proceed with the ENGINEER present during the entire operation or at least perform a sample for each type of hard surface to be approved by the Engineer.
- 10) After removal the floor material refer to the corresponding paragraph for creating the appropriate trench. This paragraph concerns only the works related to the demolition of the pavements.
- 11) DISPOSAL OF DEMOLISHED MATERIALS - Promptly dispose of debris, rubbish, and other materials resulting from abovementioned works. The remains of all these material must be removed from the site and disposed of properly in accordance with the local authorities.
- 12) CLEANING - Remove tools, equipment from site upon completion of demolition work. Only remove protections once approved by the ENGINEER.
- 13) As water is necessary to saw-cut the pavement use sparingly only potable water and must be very strictly controlled NEAR buildings.

2.2.2.B SELECTIVE DEMOLITION, REMOVAL OF CONCRETE SKYLIGHTS

PART 1---GENERAL SUMMARY

There are three reinforced concrete skylight coverings over the museum. All have failed structurally with significant exposed reinforcing steel, disintegrated concrete, broken glass cracks and deformation. The lack of maintenance especially in a marine environment with increased humidity and salts always leads to corrosion of reinforcement. Rust swells forcing the concrete cover to crack outwards reducing the available strength of both concrete and steel. This section includes the selective removal and subsequent disposal of these concrete skylights. The reinforcing steel has corroded and this is leading to failure of these caps. In addition the openings were originally designed to allow light to enter and provide ventilation.

These skylight covers are of a variety of sizes and are to be removed as indicated on the drawings. Before any demolition begins the permission and observation of the ENGINEER is required and an inspection must be conducted. Therefore this section outlines the instructions for the removal of these elements.

SUBMITTALS - Submit measurements and photographs of the areas before, during and after the demolition along with a report detailing the progress of the work. The method that will be used to prevent debris from falling down to the museum area, such as metal or wooden sheathing appropriately insulated and properly attached right underneath the concrete covers that will be demolished, must be submitted for approval.

PART 2 – MATERIALS

TOOLS – only hand power tools are permitted to remove the portland cement concrete skylights. Debris resulting from the removal of these elements must be kept on the top. Prevent debris from falling down to the Museum area and remove from the site. Utmost care must be taken that there is no one underneath during the removal as the caps are above the interior spaces, although protection has been realized.

PART 3 – EXECUTION

- 1) ALL areas for removal must be clearly marked on site with chalk before commencing work.
- 2) These areas must be inspected by the ENGINEER BEFORE any work begins.
- 3) The areas below inside the Bastion are to be blocked off in every direction to prevent falling debris from harming anyone below. Work is not to be undertaken below during this procedure. Install protective temporary metal or wooden sheathing covering the whole of the opening without open spaces and capable of receiving load from the demolition. Cover this protection with appropriate insulating material to prevent dust or water from penetrating the shaft. The museum must be closed and empty during the execution of these works for additional safety, although protection has been realized at the top.
- 4) Try to detach the concrete skylights from the stone bases and if possible remove them from the opening and then break. If not possible then break carefully into small pieces and remove. Clean the debris, leave the protection and change or repair the insulation material if damaged during the demolition so that shafts are protected from rainfall, till the new cover is installed.

CAUTION: UTMOST CARE MUST BE TAKEN AND THERE MUST BE WARNINGS POSTED AND AN INSPECTOR TO KEEP PEOPLE FROM ENTERING THE AREA BELOW THE SKYLIGHT COVERS.

- 5) Protect ALL nearby historic stone walls. The work is to be performed in safe and systematic manner. Use such methods as required to complete work indicated on the drawings and minimize disturbance. Demolish existing elements only as

indicated on the drawings and specified and with the supervision and inspection of the ENGINEER. Workers must wear proper personal protective equipment at all times. Adhere to the Health & Safety plan.

- 6) DISPOSAL OF DEMOLISHED MATERIALS - After the removal of the skylights the debris should be removed in preparation for the new cover. Promptly dispose of debris, rubbish, and other materials resulting from building site demolition operations. The remains of ALL material must be removed from the site and disposed of properly in accordance with the local authorities.
- 7) CLEANING - Remove tools, equipment and demolished materials from site upon completion of demolition work. Only remove protections once approved by the ENGINEER.
- 8) The tops of all walls are to be left clean and free of portland cement, reinforcing steel and all debris. The tops of all stone walls to be repointed and ashlar replaced in preparation for the installation of new skylights according to the corresponding paragraph. The areas are to be left clean and structurally prepared for new skylights.

2.2.2C CONCRETE STRUCTURE OVER MUSEUM ROOF

NO WORKS ARE INCLUDED FOR THIS STRUCTURE

2.2.2D SITE DEBRIS

PART 1---GENERAL SUMMARY

The top of the bastion is a place frequently visited at night, and there are numerous rubbish and broken glass bottles making visitation during the day hazardous. There is also debris from broken windows and even remains of a metal cupboard and others. All of this debris is to be removed and disposed of properly.

SUBMITTALS - Submit certificates of proper disposal to site Engineer. Submit licenses or certificates for any disposal containers to be maintained on site.

2.2.2E CONCRETE TANK

PART 1---GENERAL SUMMARY

A concrete water tank was constructed within one of the walls of the Cavalier. There is no exit for the water, or it has been blocked by vegetation. The perimeter walls of this tank suffer from severe cracking. It is to be removed. **The Contractor should engage a competent archaeologist with a minimum experience of 5 years to monitor and report during the execution of this work.**

SUBMITTALS - Submit method statement describing the methodology, materials and tools that will be used for this work. Submit the CV of the archaeologist for the approval of the Engineer.

PART 2 – MATERIALS

Hand tools are to be used and the historic walls are not to be disturbed. Large mechanized means to remove this storage tank are not to be permitted. Container will be required for storage and removal.

PART 3 – EXECUTION

- 1) ALL areas for removal must be clearly marked on site with chalk before commencing work. Approval of the Engineer is required.
- 2) It is advised that removal of the concrete starts from the perimeter parapet walls by carefully chipping away from the historic stones. The historic stones ideally should not be disturbed, but since concrete is a hard material care should be taken to cause minimum disturbance.
- 3) The contractor must investigate the thickness of the concrete walls by executing the removal of the concrete of a small area first for each side. Some of the walls may have been formed by using just cement mortar but some may have the thickness of a concrete wall. Additionally one section of the floor of the tank is to be carefully broken up by hand and explored for depth, before removing the entire floor. These sample demolitions must precede and then the contractor must submit the method and tolls he will use for the demolition to the Engineer for approval. Demolition includes also the capping of the walls with the concrete. The Contractor's employed archaeologist should be continuously present and monitor these works.
- 4) Sections of broken concrete are to be lifted over the parapet with care not to damage the walls of the cavalier. All debris is to be properly disposed of
- 5) Protect all walls from collapse by temporary shoring. Protect from rain water during all works and until the surface is backfilled since a pit will be crated on top the wall after the demolition and before completing the work.
- 6) Inspection with the site engineer is required before proceeding.
- 7) All walls are to be repointed as per mortar specifications. This includes both the exterior and interior. The cost for this work to be included in the corresponding paragraph.
- 8) The space the tank occupied is to be filled and compacted in lifts of approx. 20cm. Use aggregates similar to paragraph 2.2.2A. The final lift to be made from coarse sand with a layer of minimum 5cm thick to receive the top final layer.

- 9) The final surface will be covered with lime concrete minimum 8cm thick with plastic fiber mesh reinforcement. Provide slopes minimum of 2% as per the drainage plan on the drawings. The lime concrete will extend on top of the walls and stop 10cm before the wall's exterior faces. Its surface will be treated with trowel to become smooth and neat. The joints on top of the walls to be repaired and pointed so that water runs off.

2.2.3 GRAFFITI

PART 1---GENERAL SUMMARY

This occurs at various places on the stone walls, mostly at the roof of the bastion. This is a popular place at night, and there are no security measures. There are graffiti at various location and even paint spills at a couple of locations. Cleaning of all this is included.

PART 2 – MATERIALS

Low pressure power washers, small natural or nylon bristle brushes. STEEL BRUSHES ARE NOT TO BE USED. Chemical cleaners or harsh detergents are NOT to be used. Warm water can be used. Use clean low salt potable water.

PART 3 – EXECUTION

- 1) All areas are to be inspected with the Engineer before removal.
- 2) A test implementation is to be conducted.
- 3) A larger area is to be cleaned not only the few stones with the graffiti. The cleaning is to be blended into the surrounding area. Clean the same way at least two stones next to the ones with the graffiti at all four directions (up and down, left and right)

2.2.4 REMOVAL OF METAL FIXTURES

PART 1---GENERAL SUMMARY

There are a number of legacy metal fittings throughout the bastion installed into the stone. These include electrical metal hardware, several anchors or rods etc., on top of the bastion above the museum entrance, on the east curtain wall and on the Tower. Other fixtures include steel pipes which protrude from the Venetian parapet and Cavalier's top of walls, a metal fence on top of the Cavalier's north wall and the fence between rampart and Tower at the corner of the Museum's roof . While not critical they could easily injure visitors and impact the appearance of the site. Additionally, the metal will become corroded and will probably expand and damage the stone base. This already happened in the hinges attached to the northeast

corner of the Bastion. These are to be identified with the ENGINEER and carefully removed as they are causing damage to the walls and staining.

PART 2 – MATERIALS

TOOLS – only light hand power tools are permitted. Use scaffolding or scissor-lift as per this specification. Use hydraulic lime as per this specification and masons tools. Mortar and tools as per this specification. For cleaning the stones use clean low salt potable water with bristle fiber brushes or sponges.

PART 3 – EXECUTION

- 1) Inspection with the ENGINEER of all metal fixtures to be removed. These are then to be marked for removal with chalk.
- 2) Safety tape and fencing around the area that requires removal
- 3) Removal of marked fixtures, hardware, brackets COMPLETELY including any elements used to fix the metal fixtures such as concrete or cement pockets.
- 4) Cleaning around the area including staining and any construction debris
- 5) Repointing holes and mortar surrounding left by the removal of bolts or brackets. Repoint the entire surround area a minimum of one meter around the area to 'blend' into the surrounding wall. Clean any excessive mortar or drips from the masonry or floors.

2.2.8 GRADE ADJUSTMENT TO DRAIN

PART 1---GENERAL SUMMARY

The surface drainage is currently uncontrolled at the Bastion. The soil currently slopes toward the base of the bastion and does not drain away from the structure. This traps water at the base which permits capillary action to disintegrate the stone slowly. Water also ponds on top of the structure and slowly filters through eroding the stone. This work is carried out for the area of the Ditch. These soil areas are to be leveled and the area sloped away from the stone Walls. To do so low areas should be filled in and compacted, higher areas to be lowered and form slopes away from walls according to the drawings. The Contractor's employed archaeologist, as specified in precedent paragraphs, should monitor excavation works.

SUBMITTALS – soil fills to be approved by ENGINEER

STANDARDS: Guidelines for drainage EN 752:2008, EN 12056:2000.

PART 2 – MATERIALS

Hand carts, rakes, spades, loose and clean fill, light compactors, small mechanical excavators, clean loose fill

PART 3 - EXECUTION

- 1) This portion of the work to be executed after substantial completion of the other works to avoid disturbing the prepared slope and drainage. It is also to be

completed during the installation of the drainage system but before final surface treatment. Coordinate with the installation of the drainage system and other works.

- 2) The wall base to be inspected in detail before any leveling and pointed or re-pointed where necessary according to the corresponding paragraph.
- 3) Slope away or toward the new drainage system as per the drawings and compact. Fill low areas with loose clean fill that is void of organic matter. COMPACT FIRMLY - TAP in levels of 20-30 cm. Build up areas or remove and grade excess soil until water drains away from wall to the Ditch or toward newly installed drainage system. This process may have to be repeated several times to ensure that any repaired depression does not return.
- 4) After one week and after the first large rain return to the site for inspection to ensure drainage slopes. If low areas exist then fill and re-compact.

2.3.1 EXCAVATION, FILLING & BACKFILLING

PART 1---GENERAL SUMMARY

Provide drainage system to take water away from the top of the Bastion as well as within the interior. It is excess moisture that has led to stone deterioration near the base of the parapets and walls. Water filters through the monument eventually coming through the masonry into the interior. This action, as well as improving drainage conditions, is intended to conserve the condition the exterior stone by reducing the amount of water that percolates the structure. Therefore slopes are formed toward drainage systems or leading the water to flow away.

CAUTION: THE WALL AREA IS AN ARCHAEOLOGICAL SITE IF ANY OBJECTS OR STRUCTURES ARE FOUND DURING THE WORKS THEN THE ENGINEER IS TO BE NOTIFIED IMMEDIATELY. ANY FINDINGS MUST BE PROTECTED. SURFACE DRAINAGE EXCAVATION IS NOT TO EXCEED 0.5M (1/2 meter) IN DEPTH AT ANY TIME. IF ANY ARCHAEOLOGICAL ELEMENTS ARE FOUND WORK MUST IMMEDIATELY STOP AND THE ENGINEER CALLED. THE CONTRACTOR'S EMPLOYED ARCHAEOLOGIST SHOULD MONITOR THE WORKS.

Objects and structures are not anticipated to be found as this area, however great care must be used when undertaking this work. After the installation of the drain great care must be taken not to place equipment on top of to compress or damage the excavation, channel or any geotextile. This section covers the filling and shaping of the area on top of and near the drain and sloping and smoothing the surface material toward the drain or to guide the water to flow away from top of walls. This work is to be carried out on top of Cavalier and Rampart to slope toward the drainage systems and several earthen top of walls that are not to be covered. Drainage is included elsewhere in this specification.

STANDARDS: BS 6031, EN 1997

PART 2 – MATERIALS

Hand tools, hand carts, rakes, shovels, spades and picks SMALL self-propelled mechanical excavators. Clean salt free water to keep dust to a minimum. Refer to Materials & Equipment for detailed information. A small (compact) mechanical excavator may be used. Type of excavator and manufacture data must be submitted to the ENGINEER for approval. Light hand site equipment, shovels, rakes, hand carts. New clean gravel, clean fills.

Workers are to be trained in the use of the mechanical excavator with all current licenses for operation. The use of the excavator must comply with regulations set out by the ENGINEER. The site is to be protected at all times and excavation to begin as per the ENGINEER. When backing there must always be a second person directing.

PART 3 – EXECUTION

- 1) Earthworks that create slopes to evacuate the water naturally away from the top of the Bastion. The slopes will run from the parapet walls toward the centre or towards the drainage and then the water will be drained down the central rampart to an evaporation / percolation pit in the area away from the Bastion.

SMALL MECHANICAL EXCAVATOR PERMITTED NEAR THE WALLS. LARGE MECHANICAL EXCAVATORS ARE NOT PERMITTED NEAR THE WALLS OR ON TOP OR WITHIN THE MONUMENT. SMALL EXCAVATORS ARE PERMITTED PROVIDED SUFFICIENT PROTECTION IS PROVIDED AND THE NOTED DEPTH IS OBSERVED. OPERATOR MUST HAVE ALL APPLICABLE LICENSES.

- 2) If trenches have already been opened shore up trenches adequately to ensure there is no collapse during the installation of the drain or carrying out earthworks near the trenches. The cost for this work will be included in the cost of the trenches in the corresponding paragraphs.
- 3) Store excess material on site in a neat and orderly manner, to be used to shape grade toward drainage system.
- 4) FILLING & BACKFILLING -Spread material taken from trench area and work away from newly installed drain smoothing and lightly tapping soil. Shape soil drainage to drain toward new drain areas or take the water away as indicated on the drawings. Surface grade should slope toward drain by a minimum of 1.5% – 2% grade. NOTE: TAKE GREAT CARE ON TOP OF NEWLY INSTALLED DRAINAGE TO PREVENT DAMAGE. DO NOT PLACE HEAVY EQUIPMENT, MATERIALS, SCAFFOLDING OR STONE ON TOP OF NEW DRAINAGE SYSTEM.
- 5) On the top of the Bastion adjust surface toward drains on either side.
- 6) Revisit site after one week and after a rain and smooth out or add any additional soil to depressed or raised areas.

2.6.2 SITE DRAINAGE

PART 1---GENERAL SUMMARY

It is necessary to remove the water from the top. As there are currently low spots where water ponds on the top. This section includes installing a drain that will flow to the last catch basin and from there it will be collected and taken away by a drain pipe. It concerns the installation of this system on the Cavalier and the west side of Rampart and up to the last catch basin from where the exit pipe takes the water down to the parking area connected to the drainage system provided at the bottom of the Monument.

This is needed as excessive moisture often leads to serious deterioration of the stone. Drawings contain the location of drainage trenches, catch basins and outlets. Catch basins are to be installed at every turn in direction of the drainage pipes. To be installed at: beginning of all drainage systems, at all changes in direction, at all connections and over runs of greater than 12 to 15 meters. Secure cast iron grate over and ensure an even and snug fit. Inlet and outlet pipes to protrude by a minimum of 10 cm inside catch basins but there must contain sufficient space to work in the event cleanout is required. Place galvanized metal screen leaf catcher on all inlets to prevent debris from entering system.

The Contractor's employed archaeologist, as specified in precedent paragraphs, should monitor excavation works

SUBMITTALS - Submit sample section of perforated pipe, gravel and geotextile, pipes, precast concrete catch basin to Engineer. Product inspection and material data sheets of all materials.

STANDARDS – All geotextile must comply with EuroNorm EN 13252:2014 pipe MATERIALS and assemblies in accordance with the applicable part(s) of EuroNorm CEN/TS 13476-4:2013, EN 13476-1, EN 13476-2 and EN 13476-3, EN 1433:2002/AC:2004, precast concrete catch basin EN 206:2013, Cast iron grate is to be EuroNorm cast iron 1561:1997 EN 1253-1:2003 (WI=00165159) Guidelines for drainage EN 12502-1:2004 (WI=00262026) Protection of metallic materials against corrosion - Guidance on the assessment of corrosion likelihood in water distribution and storage systems; EN 933-5:1998 (WI=00154017) Tests for geometrical properties of aggregates

PART 2 – MATERIALS

Perforated PVC drain pipe shall be continuously perforated slotted with minimum openings of 2mm ON THE TOP AND SIDES ONLY with smooth interior with a minimum inside diameter of 10 cm. Gravel shall be 1cm – 3 cm uniformly graded coarse washed and clean and free of salt and dirt. Geotextile to be of synthetic polymer compound NONWOVEN with variable small openings of minimum size of .211 mm of #70 with a percent open area of 4% and with a tensile strength of 100kg., provided by a certified ISO 9001:2008 manufacturer and to be resistant to ultraviolet degradation and biological and chemical environments and salts. (Propex 401 , Geosynthetics, BASF or equivalent) Rolls of geotextile shall be stored in vertical positions in staging area and protected from moisture, dirt, excessive heat and the sun until installation. Cover shall remain on the roll until use. Ensure proper cover upon installation and sufficient

overlap. Precast concrete catch basin, gravel base, precast concrete catch basin, galvanized leaf screen fittings, iron grate.

IF pipe with slots on the top and sides only is not available then pipe with slots all around may be used PROVIDED the bottom the trench is modified to incorporate a solid base of lime concrete to block the holes at the bottom and up to the mid height of the pipe, permit positive drainage. The formation of the trenches should prevent the water from ponding inside the trench.

ALL MATERIALS WITH THEIR CERTIFICATES, THE METHOD STATEMENT AND A SAMPLE SHOULD BE SUBMITTED FOR THE APPROVAL OF THE ENGINEER.

PART 3 – EXECUTION

- 1) Protect trench and surrounding area from compaction prior to installation. Install the drainage system after other site activities are complete to prevent damage from other activities. If other activities have to be carried out after the installation of the drainage system then it's the contractor's responsibility to protect its completed work not to be damaged and if it is damaged to repair according to the specifications and to the Engineer's approval.
- 2) The bottom of the trench should be uniform and level un-compacted subgrade free from rocks, debris and vegetation. Any work or removal of soil should be accomplished with hand tools.
- 3) Line the bottom and sides of the trench with geotextile with any overlaps of 0.5 (1/2) meters. Fold back edges at the surface and secure at least 0.5 m excess geotextile with stones. Geotextile prevents fine soil and sand from entering and then clogging the drainage system thus extending the life of the drain system. Cover with geotextile the top of the pipe as well so that any soil that may flow into the trench doesn't penetrate into the pipe.
- 4) Line the bottom of the trench with up to 10cm of gravel to create slope of drainage pipe. Install perforated drain pipe to slope specified for drainage between 1.5% - 2% and support throughout length with gravel underneath and to both sides. Connect lengths of pipe as per manufacturer's specifications. Ensure that gravel is on both sides of trench and pipe is clean and free of dirt and debris.
- 5) The foundation for the catch basin shall be constructed of compacted gravel and shall be a minimum thickness of 20 cm. The top of the precast concrete catch basin will be recessed from the surface grade and a continuous notch formed for the receiving of a cast iron grate. The cast iron grate is to be fitted snugly into the formed top of the pit and is to have slotted openings of 3-5 cm and a minimum thickness of 5cm. A wire galvanized steel screen shall be placed over the drainage inlet pipe to prevent the passage of debris. Backfill shall be clean gravel as specified elsewhere in these specifications. The surface shall be graded and compacted so the surface slope is toward inlet. Upon completion each inlet or catch basin shall be thoroughly cleaned of any accumulated silt or debris and shall be maintained free of such materials until acceptance of the work and system testing.

NOTE: TEST ENTIRE LENGTH OF PIPE AND CHANNEL FOR POSITIVE DRAINAGE BEFORE THE INSTALLING ANY ADDITIONAL GRAVEL OR COVER AND BACKFILLING TRENCH. ENGINEER MUST BE PRESENT DURING TESTING.

- 6) The slotted tube will be placed in the trench. Its installation will begin from a catch basin at the head of the collection system in the direction of the slope. The pipes will protrude into the catch basins as per the drawing details and mentioned above. The pipes will be laid at a slope, minimum, of between 1.5%-2%. Catch basins will be positioned at ALL changes of direction, connections and maximum every 12 to 15m in straight lines of the drainage system. The locations of these catch basins are shown on the drawings.
- 7) The trench will be filled with gravel as a filter material. The drains will conduct water to the evaporation pit to the west as shown on the drawings.
- 8) Construct evaporation/percolation pit at the end of the system to allow the disbursement of water as per drawings. The evaporation pit and the exit pipe are described and will be priced elsewhere

2.6.2.B SURFACE DRAINAGE

PART 1---GENERAL SUMMARY

Currently water collects or ponds in areas of the Bastion. This water eventually filters down into the masonry vaults and saturates the stone ashlar. Therefore it must be drained. This section deals with the installation of surface drains to excavate the water. These open drains are easier to maintain and keep clear. These open surface drains are implemented at the Rampart and Tower areas.

The Contractor's employed archaeologist, as specified in precedent paragraphs, should monitor excavation works

SUBMITTALS - Submit mix design of the lime concrete to be used and method of producing, laying and curing of the lime concrete that will be used for the open drain. Prepare samples for testing the color the strength and the water absorption of the lime concrete. Results together with a method statement should be submitted to the Engineer for approval before commencement of work. Provide sample of the cast in situ open drain for approval.

STANDARDS – *The linear drainage channel shall comply with BS EN 1433. Concrete BS EN 1916. EN 12056-3:2000, EN 1253. EN 1433:2002. EN 1610, CEN/TR 15125:2005 (WI=00125112) Design, preparation and application of internal cement and/or lime. EN 459-1:2010 (WI=00051084) Building lime - Part 1:Definitions, specifications and conformity criteria, ASTM C141: Standard Specification for Hydraulic Hydrated Lime for Structural Purpose*

PART 2 – MATERIALS

Lime concrete, surface grading materials, clean low salt potable water, special sand or dust color admixture to obtain the required color of lime concrete.

PART 3 – EXECUTION

- 1) Mark on the ground the location of the surface drains for approval by the ENGINEER. This should be as shown on the drawings but current conditions may alter slightly the location.
- 2) Work on this should only begin after the surface grading is substantially complete. Slope the surrounding areas toward this drain with a minimum slope of 1.5% as shown on the drawings
- 3) Excavate the appropriate area to provide the necessary working space to create the open channel for the surface drain. Immediately begin work on the realization of the surface drain. Slope and compact the bottom of the excavation accordingly.

- 4) Create a wood form inside this excavation for the pouring of the hydraulic lime concrete. Before pouring the drainage channel obtain the permission and approval of the ENGINEER.
- 5) Pour the hydraulic lime concrete into the form as per the drawings – minimum slope to be 1.5 – 2%. Lime to comply with this specification and shall be consistent in color and texture throughout the drainage system. Remove the formwork only after the surface drain is sufficiently cured. Keep moist by using wet burlap fabric for at least 7 days.
- 6) Backfill the edges compacting to the edges of the surface drain carefully to avoid damaging the drain. Should cracks or voids appear patch and fill using similar material.
- 7) Test the entire system for positive drainage and leave the entire area clean

2.6.2.C DRAINAGE ON TOP OF WALLS – EARTH SURFACES

PART 1---GENERAL SUMMARY

The top of Cavalier's and some of the tops of the Tower's walls, between gun ports - embrasures, are covered with earth surface. This allows the percolation of water increase of earth pressures and deterioration of joints and stones. The water must be drained away.

Cleaning of plants that have grown on these surfaces, the removal of the concrete tank and the repairs of walls are included in other paragraphs of this specification. This paragraph concerns the treatment and drainage of the surface.

SUBMITTALS – Submit mix design of the lime concrete to be used and method of producing, laying and curing of the lime concrete bed – layer that will be used to cover the surfaces. Prepare samples for testing the color the strength and the water absorption of the lime concrete. Results together with a method statement should be submitted to the Engineer for approval before commencement of work.

STANDARDS – CEN/TR 15125:2005 (WI=00125112) Design, preparation and application of internal cement and/or lime. EN 459-1:2010 (WI=00051084) Building lime - Part 1: Definitions, specifications and conformity criteria, ASTM C141: Standard Specification for Hydraulic Hydrated Lime for Structural Purposes

PART 2 – MATERIALS

Hydraulic lime, fine gravel 8-16mm, potable water to produce concrete, mesh fabric for reinforcing against surface cracks, wood forms, masons tools. Indicative proportions 60lit of gravel, 40Kg hydraulic lime (NHL or HHL) and 15-20lit of water. Use dust color of the approval of the Engineer to obtain the required color of Lime concrete.

PART 3 – EXECUTION

- 1) Slopes are shown on the drawings. Nonetheless inspect all areas with the ENGINEER and determine best location and direction for slope to drain water away from the top of the walls
- 2) Excavate the soil to the depth required to place the lime concrete layer. Remove all sharp stones and gravels from the surface and form slopes 1.5 to 2.0% on the soil base. Fill recesses with the gravel. Wet and compact the soil base adequately. The Contractor's employed archaeologist, as specified in precedent paragraphs, should monitor excavation works
- 3) Pre-wet subsurface and pour hydraulic lime concrete for a thickness of approximately 4cm. Install fiberglass mesh reinforcing and pour remaining thickness to a total of 8cm. The concrete should be poured than the top of the perimeter stone parapets and cover the perimeter walls but remain at a 10cm recess from the edges so that water flows on top of the walls and then drains away. The repair of joints on top of the walls is included elsewhere in this specification.
- 4) Pour the lime concrete in strips maximum 2.0m wide and with a length equal to the top wall's leaving intermediate strips empty and after maturing pour the intermediate strips to reduce maturing shrinkage cracks.
- 5) Maintain wet surface and DO NOT APPLY BELOW 5 DEGREES OR ABOVE 35 DEGREES. After application keep moist with wet burlap fabric for at least 7 days.
- 6) Return after application to infill any cracks or voids, test for water drainage. Treat the perimeter joint between lime concrete and parapet using hydraulic lime mortar according to the specifications.

2.6.2.D DRAINAGE ON TOP OF WALLS – COVERED SURFACES

PART 1---GENERAL SUMMARY

The top of the Rampart's and some of the Tower's walls, between gun ports - embrasures, are covered with lime or concrete mortar. This layer protects from the percolation of water, however it has partially deteriorated in certain areas, usually near the end of the slopes close to the parapet and the spouts but at other locations as well. This helps the percolation of water. This results in the growth of plants and the deterioration of joints and stones at walls and embrasures. The water must be drained away.

Cleaning of plants that have grown on these surfaces and the repairs of walls are included in other paragraphs of this specification. This paragraph concerns the repair of the joints of the stone built surface that will be exposed and the treatment of the surface after plants have been removed.

SUBMITTALS – Submit method statement and lime mortar mix to the Engineer for approval.

PART 2 – MATERIALS

Hydraulic lime mortar as per specifications and polypropylene fibers according to EN14889. Mason's tools. Clean low salt potable water, special sand and/or dust color to obtain the required color for the Engineer's approval.

PART 3 – EXECUTION

- 1) Clean existing surface where the lime or concrete existing cover has deteriorated. Inspect all areas with the ENGINEER and determine the areas where the existing cover will be removed and the new lime mortar will be provided, as well as the best location and direction for slope to drain water away from the top of the walls.
- 2) Pre-wet subsurface and apply hydraulic lime mortar to cover the area and at the same time fill gaps and form the slopes to the water outlets. The thickness of the mortar may vary from location to location. In case of significant recesses fill them by using coarse sand wet and compact and then cover with the lime mortar. The average thickness of mortar should be around 25 to 30mm. Use polypropylene fibers in the mix to reduce hair cracks. Apply the mortar in strips to allow shrinkage to develop and reduce potential hair cracks.
- 3) Maintain wet surface and DO NOT APPLY BELOW 5 DEGREES OR ABOVE 35 DEGREES. After application keep moist with wet burlap fabric for at least 4 days.
- 4) Return after application to infill any cracks or voids, test for water drainage. Treat the perimeter joint between lime mortar and parapet using hydraulic lime mortar according to the specifications.
- 5) Repair all the existing parapet holes that are used as water outlets and the ones that were used as outlets in the past although they are not used with this design. All these holes are to be cleaned from vegetation and debris, joints to be cleaned and repaired with lime mortar and then lime mortar will cover their entire perimeter.

2.8.2 INSTALLATION OF SAFETY FENCE

PART 1 - GENERAL SUMMARY

After the intervention the Bastion will be open to visitors. Therefore it is necessary to control safety at certain portions of the monument. This section deals with control barriers to be placed at certain locations and can be prefabricated off site. The locations and designs of these barriers are noted on the drawings.

SUBMITTALS - Submit shop – detailed drawings for approval. After approval a prototype must be constructed and installed on site for approval by the ENGINEER. Submit certificates for the footing reinforcement and mix design for the footing concrete. Submit certificates for structural steel components and bolts. Submit certificate for concrete admixtures.

STANDARDS - CEN ISO/TR 15608:2013 (WI=00121626) Welding - Guidelines for a metallic materials; CEN ISO/TR 3834-6:2007 (WI=00121451) Quality requirements for fusion welding of metallic materials; EN 10238:2009 (WI=EC103050) Automatically blast-cleaned and automatically prefabrication primed structural steel products. EN 50059:1990 (WI=489) Specification for electrostatic hand-held spraying equipment. EN 82079-1:2012 (WI=23298) Preparation of instructions for use. EN ISO 11124-1:1997 (WI=00139092) Preparation of steel substrates before application of paints and related products. EN ISO 12944-1:1998 (WI=00139055) Paints and varnishes - Corrosion protection of steel structures by protective paint systems. EN ISO 12944-5:2007 (WI=00139169) Paints and varnishes - Corrosion protection of steel structures by protective paint systems, EN 1993:2005 – design of steel structures, EN1992- design of concrete structures

PART 2- MATERIALS

Guard uprights to be of steel sections to the sizes shown in the drawing with stainless steel cables. ALL steel to be primed and painted with a minimum of two coats of marine primer and paint. Cables and tensioning buckles to be of stainless steel including all fasteners and bolts. All welds to be continuous, clean and neat. Assembly to be fastened to new isolated concrete footings using expansion holding down bolts according to the details.

PART 3- EXECUTION

- 1) Install prototype for approval by the ENGINEER.
- 2) The elements of the barrier can be prefabricated and welded off site and installed in such a way to be easily removable in the future.
- 3) Protect ALL metal SURFACES with sufficient marine primer and then two coats of marine rust-inhibiting paint sufficiently to prevent corrosion. The color to be approved by the Engineer. All shop fabrication work, marking, delivering, unloading, hoisting, erecting and fixing as per detail drawings, and method to be approved by the Engineer. Welding is deemed to be in accordance with the specifications. Gusset plates, shoe plates, end caps, cleats, brackets, stiffeners, bolts to be included in the rate of the associated steel work. All welds are to be 6mm thick fillet weld and allowance for rolling margin. Grind to a smooth finish. Machine drilled bolt, holes nuts washers, cleats shoe and gusset plates and all other connections. After fabrication wire brush to clean all steel surfaces including holes and protect and paint as mentioned above.
- 4) Install isolated concrete footings to the dimensions and with the reinforcement shown in the drawings. The concrete quality should be C25/30 and the quality of the reinforcement B500C. Waterproofing admixture to be used for the concrete. Materials

- 5) Touch up all exposed or damaged metal pieces.
- 6) TEST BARRIER FOR SAFETY IN LATERAL DIRECTIONS IN ACCORDANCE WITH ALL LOCAL SAFETY REGULATIONS

2.9.0 SITE PLANTS/VEGETATION

PART 1---GENERAL SUMMARY

There are numerous plants growing on top of the bastion and in the ditch. These were cut for the condition assessment report, but during winter and spring, they will regrow. Already during the design phase some plants started to grow. During the grade adjustment to drains certain areas may be excavated and plants will be removed. For areas that have to be filled while plants have already started to grow the plants have to be removed. Herbicide should be sprayed on these surfaces to prevent growth of plants. Growth of plants has developed also on top of the walls of the Cavalier, the ramparts and the Tower. Herbicide must be sprayed and the plants to be removed. This paragraph concerns all horizontal or horizontal but slopping areas of the study, which includes the top of the Cavalier's surface and walls, the top of the Tower's surface and walls and top of the rampart's surface and walls and the top surfaces of the stepping north curtain walls.

SUBMITTALS – Submit the herbicide to the Engineer for approval.

PART 2- MATERIALS

Work has to be carried out by hand using mostly gardening tools. Use herbicide with caution and use safety equipment for its application, such as safety glasses, gloves and masks. For herbicide use herbicide boxer or Kimistone biocide or equivalent. Since this work include also cleaning of existing concrete or lime mortar surfaces if mosses lichens and algae have developed instead of herbicide apply biocide such as New Desogen, Preventol R150, Remmers-BFA or equivalent of the Engineer's approval

PART 3- EXECUTION

- 1) Apply herbicide and wait the appropriate time according to the manufacturer's specifications.
- 2) Remove plants, collect in a container and dispose.

2.9.5 SITE ENCROACHMENT

PART 1---GENERAL SUMMARY

~~There are issues of encroachment with two restaurants established against the bastion along the curtain wall adjacent to the port. The businesses below the bastion should thrive because they are economically important, however, their location is questionable in the restricted space directly below the bastion. They are currently damaging the walls with smoke and oil fumes from their grills as well as attaching~~

~~electrical cables, air conditioning equipment and positioning their trash receptacles against the Bastion. Water is also drained against the walls from these restaurants. These restaurants have also added inappropriate interventions in electrical installations and non permeable paving materials. This forces additional moisture into the wall leading to further derogation. Customers to the restaurants park alongside the wall obstructing the view of this monument and creating a hazardous traffic situation. The works necessary for resolving this problem are not included in this project.~~

03 DIVISION - GROUTING

3.6.4 INJECTION GROUTING LARGE CRACKS

PART 1 GENERAL SUMMARY. The existence of many cracks has been observed in the walls of the Bastion. Cracks develop due to various reasons such as the deterioration of the base, additional load on top of the structure, old damages from the history of the monument that have never been properly addressed and with the deterioration came forward. It is absolutely necessary seal them and reinstate the connection between the two parts of the crack. This is to avoid the deterioration by further opening of the crack and will ensure the strengthening of the mechanical properties of the wall since the two separated parts of the structure will be connected at least with a compatible mortar. It will also prevent the future detachment of ashlar from the wall.

SUBMITTALS – Contractor to submit to ENGINEER a location map for drilling along with a sample of the injection mortar and identification of drill to be used. Contractor to submit the type and product data sheet of hydraulic lime mortar to be used for grouting and identification of drill to be used.

STANDARDS- All grout to be tested before and after injection according to EuroNorm standards CSN EN 445; CEN/TR 15125:2005 Design, preparation and application of internal cement and/or lime; CEN/TR 196-4:2007 Methods of testing cement - Quantitative determination of constituents, EN 998:Specification of mortar for masonry, EN 1015:methods of tests for mortar for masonry

PART 2 – MATERIALS

Use appropriate equipment that will include in one the mixing machinery and the injecting gun. It should include a manometer to measure the pressure and the appropriate hoses and nozzles. Alternatively use a separate mixer to mix the grouting and a pressure system to inject the grouting, again with the manometer and the hoses and nozzles.

Use drilling to open the holes in the crossing of masonry joints. Clean the hole using only air under pressure to remove excessive dust. Use plastic tubes 12-16mm of diameter penetrating at least 35cm into the wall and extending outwards at least 15cm. Their last 10cm into the wall have to be perforated around their perimeter to allow grouting to pass from the perimeter as well as the end.

Use appropriate caps to seal the tubes after grouting has finished. Alternatively bend the tube and tie using wires to prevent the grouting from spilling out. Use a ready-made hydraulic lime based grouting with fine aggregates and high fluidity, designed especially for grouting for restoration of masonry buildings and as specified elsewhere in the specifications like KIMIA – LIMEPOR 100 or BASF - Albaria Iniezone or equivalent.

Have available gypsum to immediately block leakage that may occur from adjacent joints. After concluding the grouting this gypsum has to be cleaned off.

Specifications or physical samples for all materials and equipment should be provided to the Engineer for approval.

PART 3 - EXECUTION

- 1) A visual assessment of the masonry condition should be conducted. Each area should be mapped as the size and extent of the damage, cracks and voids.
- 2) Cleaning of crack by mechanical methods
- 3) Sealing of the possible outputs of mortar injection, using hydraulic lime mortar. Joints at both sides of the crack and to a width of 80cm have to be sealed. For sealing the cracks lime mortar according to this specification must be used and probably, depending on the crack's width, small pieces from the stone material. In such a case a sample should be carried out for the Engineer's approval.
- 4) Injection points along the crack should be placed at distances of not more than 50cm. The contractor should provide a drawing identifying the locations of the injection points, or identify them on site. This has to be approved by the Engineer before commencing the drilling. These points will ONLY be located on the joints of ashlar and along the crack.
- 5) Carry out rotary drilling of 12-16 mm in diameter with penetration of the wall to a minimum depth of 40 cm.
- 6) Put the plastic tubes 35cm in the points of the injection and seal with mortar around the tubes.
- 7) Injection of the fissure with the mortar approved by the ENGINEER. The mortar will be fluid to penetrate in the interior of the wall to fill the space opened by the crack. The injection will begin at the bottom (for gravity). When the grout appears at the second point of injection, then seal the first and continue with the injection to the injection point above. If no communication has been reached between points then inject the quantity of grouting considered in the BoQ and consult the Engineer to proceed to the next injection point.
- 8) Injection process shall be verified through the extraction of cores in areas where the injection was carried out as per the ENGINEER.
- 9) Injection shall proceed from the base of the repair area to the top moving first across the wall horizontally then upwards.
- 10) Plug tubes after injection has finished using appropriate plastic or wooden plugs or by folding and tying the tubes
- 11) After the grouting has matured and with the approval of the Engineer remove the tubes and use thicker mortar from the same material to fill the hole that will be created by removing the tube to a recess to apply pointing mortar.
- 12) The surface of the wall should be cleaned after injection immediately. Clean with water and a stiff nonmetallic fiber bristle brush hand operated. Allow grout to stiffen but not set completely and point the injection holes with a mortar similar in color and composition.

04 DIVISION - MASONRY

4.0.6 LIME (HYDRAULIC) MORTAR CHARACTERISTICS

PART 1 - GENERAL SUMMARY

This standard includes guidance on preparing lime mortars for re pointing and use in historic masonry. Lime mortars are preferable to portland cement mortars for repointing and consolidation of historic masonry. Lime mortars are more permeable by water. Water passing through lime mortar will dissolve a small portion of the lime and then will deposit it in hairline cracks as the water evaporates. Lime mortars expand slightly during setting, and resists shrinkage which causes cracking. An analysis of the mortar bonds reveals principally lime-based mortar, some of which show acute deterioration. New lime-based mortars will therefore be applied both for re-pointing, consolidation, grouting and for rendering. The following section outlines the mortar to be used.

SUBMITTALS - Product Data: Submit manufacturer technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that MATERIALS comply with requirements. Submit written program for each phase of re-pointing process including protection of surrounding materials on building and site during operations. Describe in detail materials, methods and equipment to be used for each phase of restoration work. **Samples:** submit, for verification purposes, prior to conducting work on the entire monument a sample area. Prepare two separate sample areas of approximately 3 meters high by 6 meters wide for each type of re-pointing required, one for demonstrating methods and quality of materials and workmanship expected in removal of mortar joints, and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints.

QUALITY ASSURANCE - Qualifications: must be performed by a mason having not less than five years successful experience in comparable masonry restoration projects and employing personnel skilled in the restoration processes and operations indicated. All technicians planned for use on the job will be required to successfully complete 1m of cutting and raking of mortar joints in the presence of the ENGINEER prior to working on the job. Unsuccessful performance in this test area will be grounds for rejection of this technician for this job.

STANDARDS- All mortar to be tested before and after application in according to EuroNorm standards CSN EN 445; CEN/TR 15125:2005 (WI=00125112) Design, preparation and application of lime; CEN/TR 196-4:2007 (WI=00051045) Methods of testing - Quantitative determination of constituents. Physical properties: Standard Test Method for Determination of Pore Volume and Pore Volume Distribution of Soil and Rock by Mercury Intrusion Porosimetry, as per standard ASTM-D4404-84 (1998). Hydraulic properties: Natural stone. Test methods. Determination of water absorption at atmospheric pressure, as per standard UNE-EN 13755: 2002. Mechanical properties: Mortars, test methods. Determination of flexotraction and compression resistance. UNE

83-821-92; EN 1015:Methods of test for mortar for masonry, EN 998:specification for mortar for masonry.

PART 2 - MATERIALS

Tools: Trowels, chisels: Joint chisels or a standard mason's chisel with a 4cm blade and a long narrow handle Hammers: 5# stone dressing hammer 2# striking hammer. No-Bounce" hammer, Full size and one half size brick hammers, Joint Tools: raised beaded tool, beaded striking tool, raised beaded tool with offset handle, flat joint iron. Pointing tool should be narrower than the joint being filled to achieve good compaction. Plywood or steel mortar board, Natural bristle brushes, Stiff bristle brushes NO WIRE BRUSHES ARE TO BE USED, Spray bottle. Water: Clean low salt potable water and free of any amounts of oil, acid, alkalis and organic matter. Use dust color to the minimum required quantity to obtain the color for the Engineer's approval.

MORTAR SPECIFICATIONS

Premixed aggregates - Use of a commercial mortar with aggregates incorporated in the commercial dosage like

ALBARIA Calce Alletamento mortar manufactured by BASF OR LIMEPOR mortar manufactured by KIMIA OR EQUIVALENT.

This is a lime-based and metakaolin mortar of a whitish color indicated for the repair of masonry walls and mortar joint filling. This mortar already contains pre-mixed aggregate and it only has to be mixed with water following the instructions in the technical sheet. Its salt content will therefore remain below 100 µS. cm-1.

With regard to the mechanical and hydraulic properties, the following table provides a comparison of the data from the technical sheet:

Property	Commercial Mortar
Density	15.4 KN/m ³
Salts-conductivity	86 µS. cm ⁻¹
Capillary absorption	--
Compressive strength	7.5 MPa

In view of the above technical specifications, it appears that the mortar is compatible with the masonry materials, such that its use is therefore recommended. Nevertheless, it was recommended that certain tests be conducted during the works, to ensure compliance with the specifications on the technical sheet. The following tests are recommended:

Conductivity measurement once mixed. It should have a conductivity of below 100 µS. cm-1. Color. The question of color should be validated by ENGINEER.

NOTE: THE QUESTION OF COLOR IS VERY IMPORTANT IN BOTH OPTIONS AND MUST BE ADJUSTED BY AN EXPERIENCED MASON WITH THE OVERSIGHT AND APPROVAL OF THE ENGINEER.

PART 3 – EXECUTION

1) THE MIX OF THE MORTAR

Bedding Mortar Mix Proportions: Mix by Volume.

Mixing Procedures: Measure materials by volume or equivalent weight.

Do not apply or mix mortar on outside surfaces with standing water or outside during rain. Mortar mixing should be done only in the shade; Cover mortar in hot weather to reduce evaporation.

NOTE: USE A KNOWN MEASURE. DO NOT MEASURE BY SHOVEL.

Mix ingredients in clean mechanical batcher for 5-10 minutes. Measure mortar and aggregate material in a dry condition by volume or equivalent weight. Do not measure by shovel, use known measure. Mix materials in a clean mechanical batch mixer.

Consistently and accurately measure materials for each batch.

Mix for at least five minutes in a mechanical batch mixer or mortar box. Mix trowel workable consistency for unit masonry setting and resetting.

Thoroughly mix mortar and aggregate materials together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix which will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 1-to-2 hours. Add remaining water in small portions until mortar of desired consistency is reached. Use mortar within 30 minutes of final mixing; do not re-temper or use partially hardened material.

- 2) Let mortar sit for 1 hour prior to use to allow for initial shrinkage. Remix mortar to workable consistency. Use mortar within 1.5 hours of initial remixing. Discard left-over mortar. DO NOT REMIX.

Discard mortar not used within two hours after mixing; do not re-temper at mixer.

Dispose of waste mortar and cleaning water in approved manner; do not contaminate the site, adjoining property, or waste to sewers.

- 3) Colored Mortar: Produce mortar of color required by use of selected ingredients. Do not adjust proportions without ENGINEER's approval.

Color Pigmented Mortar: Where colored mortar pigments are indicated, do not exceed pigment-to-cement ratio of 1-to-10, by weight.

Match original color and texture for each kind of mortar and masonry work. Match to inner mortar color which has been protected from weathering and soiling, not face color.

Do not use admixtures of any kind in mortar, unless otherwise indicated.

- 4) Field Samples: Prior to start of general masonry restoration, prepare the following sample panels on building where directed by Engineer. Obtain ENGINEER'S acceptance of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, suitable designated during construction as a standard for judging completed work

5) DELIVERY, STORAGE AND HANDLING

Storage and Protection: Protect masonry restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other type materials. Protect grout, mortar, and other materials from deterioration by moisture and temperature. Store in a dry location or on waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

6) PROJECT/SITE CONDITIONS

Existing Conditions: No stone work will be performed when the air temperature is 10 C and falling or when stone surface temperature is 10 C or below. **DO mix OR APPLY IN TEMPERATURES EXCEEDING 35 DEGREES OR WHEN ANTICIPATED TO BE HIGHER. In warmer temperatures over 25 degrees apply in the afternoon and cover with damp cloth and keep moist**

4.4.3A INSTALLATION OF NEW ASHLAR STONE AT BASE OF WALLS

PART 1---GENERAL SUMMARY

There are several locations at the base of the Walls where the ashlar are completely missing either due to erosion and disintegration of lower courses, which then resulted in the collapse of upper courses or other actions. These are necessary for the stability and strength of the walls and must be rebuilt.

NOTE: THIS PROCEDURE MUST BE PERFORMED BY AN EXPERIENCED MASON.

PART 2---MATERIALS

Mason tools used for building stone walls and handling mortar as per the specifications. Use readymade hydraulic lime mortar according to the specifications. Use stone material preferably from same origin or at least compatible with the existing stone material. Compatible means that physical and mechanical characteristics should

be same with the existing stones. This means that the stone must be provided by a quarry close to the area and that must be tested to prove its characteristics.

SUBMITTALS:

Hydraulic Lime; and manufacturer's printed recommendations for product use and installation. Certifications: Prior to delivery, submit certificates attesting to compliance with applicable specifications for grades, types and classes.

Stones: Preferably obtain stone from the same origin, which is from a quarry near the area of the fortifications, since the historical analysis proved that stones came from the Ditch and/or from a nearby quarry. Appropriate stone material should match the physical and mechanical properties as much as possible to the original material, such as mineralogical composition, color, density, porosity, hydraulic and mechanical characteristics, compressive and tensile strength, absorption. With regard to the mechanical properties, it especially worth noting that a more appropriate stone material will present strengths and modulus of elasticity that is equal or slightly less than that of the original material.

It is necessary to provide detailed quality control of the materials used on site while the work is ongoing. The tests must be carried out by specialized laboratories and the assessment of the results should be done by technical experts. Therefore samples of the stones and location from which they were taken as well as tests as mentioned above must be submitted to the ENGINEER for approval. This must be done at least a month in advance for determining if the stone selected fulfills the requirements.

Ashlar stones will be used to match the existing ones. Since several are completely missing, sizes will be obtained from the existing traces at the back of the recess, the existing stones around the areas missing and the pattern that can be recorded from the areas where the stones are still in place. A drawing must be prepared with the sizes of the stones or these should be marked on the structure itself. Anyhow this will be required for ordering the stones and once prepared should be submitted to the Engineer for approval.

PART 3---EXECUTION

- 1) Clean the area from loose materials and debris, i.e. mortar, soil, sand, small stone pieces etc. Clear the bottom to find the lower course or bedrock whichever is found first. Check if the base found is sound or there are eroded stones that must be replaced and clean them also. Report the findings and the method to the Engineer for approval.
- 2) Pre-wet adjacent surfaces with clean low salt potable water. Use appropriate horizontal and vertical string lines attached with nails to the joints to form the surfaces that should be followed and obtain approval by the Engineer. After removing the strings repair the joints affected

- 3) Set stone in an evenly filled bed of mortar, with full mortar coverage on horizontal and vertical joints. Maximum tolerances from plumb and level new work, not to exceed variation from plumb and level of adjacent existing work. Match existing placement, pattern and location. Note: If replacement units are required, they should match original sandstone in color, texture, and size, and be free from salts and other contaminants.
- 4) Construct uniform joints. Shove vertical joints tight. Adjust stone units to final position while mortar is soft and plastic. Set stone with joints tooled back 1cm. Point remaining depth as the rest of the stone is pointed.
- 5) Keep mortar and stone damp until mortar is cured and not less than 3 days.
- 6) ADJUSTING/CLEANING. Stones should be cleaned before the mortar to remove mortar, grout and adhesives from the face of the masonry. Clean stone only with bristle fiber brushes and water. No acids or strong detergents to be used.

4.4.3B INSTALLATION OF NEW ASHLAR STONE AT EMBRASURES, WALLS AND PARAPETS

PART 1---GENERAL SUMMARY

Rebuilding lost sandstone units. This procedure can be used also for re-setting loose sandstone ashlar, since the stone material is there but loose. The difference is that rebuilding requires new ashlar stone while resetting removes the existing stone and builds it back to its original location.

Use same paragraph for pricing distinguished the two cases between them as installation of new ashlar for the first case and resetting existing ashlar for the second one.

INFILL ALL HOLES AND REPLACE ALL ASHLARS WITH NEW QUARRIED STONE WHERE LOSS IS GREATER THAN 50% - ENTIRE STRUCTURE. SEE ANNEX OF PHOTOGRAPHS OF ASHLARS TO BE REPLACED.

NOTE: THIS PROCEDURE MUST BE PERFORMED BY AN EXPERIENCED MASON.

SUBMITTALS – Hydraulic Lime; and manufacturer's printed recommendations for product use and installation. **Certifications:** Prior to delivery, submit certificates attesting to compliance with applicable specifications for grades, types and classes. **Joint Raking:** Prior to raking out all areas, cut back joints at location selected by Conservator Supervisor and approved by the Engineer, until an acceptable sample is achieved. This area will serve as standard for joint raking for the entire job. It will be marked and left un-pointed until all other pointing is complete. Re-point when directed by the ENGINEER.

Sample Stone Pointing and Repair: point and re-point joints, re-attach stone fragments and repair stone using materials and methods specified at a location(s) selected by the ENGINEER. The samples accepted by the ENGINEER will serve as a standard for the entire job. They will be marked and left undisturbed.

To obtain sand/aggregate that matches historic, have a sample analyzed. Color and texture should be closely matched to eliminate need for pigment additives which can fade and reduce strength of mortar. Environmental Requirements: No stone pointing or repair shall be performed when the air temperature or stone surface temperature is 5°C and falling during and for 48 hours subsequent to laying.

PART 2---MATERIALS

As per General Conditions and Materials & Equipment

An appropriate stone material that match the present properties that are as similar as possible to the original material, such as mineralogical composition, color, density, porosity, hydraulic and mechanical characteristics, compressive and tensile strength, water absorption. With regard to the mechanical properties, it especially worth noting that a more appropriate stone material will present strengths and modulus of elasticity that is equal or slightly less than that of the original material. Refer also to the other paragraphs of this specification related to stone material.

SUBMITTALS – It is necessary to provide detailed quality control of the materials used on site while the work is ongoing. The tests must be carried out by specialized laboratories and the assessment of the results should be done by technical experts. Therefore samples of the stones and location from which they were taken must be submitted to the ENGINEER and UNDP office for testing. This must be done at least three weeks in advance for determining if the stone selected is the same as stone identified in the preliminary investigations.

PART 3---EXECUTION

- 1) For Small Stones: Carefully remove small shifted and/or loose sandstone units. Clean of dirt, mortar, and loose debris. Retain for re-use. Re-build support masonry and lay new bedding material.
- 2) Remove loose debris from the stone cavity, and rinse with water to remove dust.
- 3) Pre-wet adjacent surfaces with clean, potable water.
- 4) Put stone in an evenly filled bed of mortar, with full mortar coverage on horizontal and vertical joints. Maximum tolerances from plumb and level new work, not to exceed variation from plumb and level of adjacent existing work. Match existing placement, pattern and location. Note: If replacement units are required, they should match original sandstone in color, texture, and size, and be free from salts and other contaminants.

- 5) Construct uniform joints. Shove vertical joints tight. Adjust stone units to final position while mortar is soft and plastic. Set stone with joints tooled back 1cm. Point remaining depth as the rest of the stone is pointed.
- 6) Keep mortar and stone damp until mortar is cured but at least for 3 days.
- 7) For Large Stones: DO NOT REMOVE. Tightly secure large stones using wooden wedges soaked in water. Carefully clean joints of loose mortar and other debris. Use air pressure to remove excessive dust and wet the joints. Use grouting handguns and hydraulic lime mortar according to the specifications to fill the joints up to pointing depth and re-point in place. Refer to ENGINEER for guidance on re-pointing sandstone.
- 8) ADJUSTING/CLEANING
At the time of repairing, patching, pointing and re- setting of the stone, immediately remove mortar, grout and adhesives from the face of the masonry. Clean stone only with bristle fiber brushes and water.

NOTE: USE NO ACIDS, DETERGENTS OR OTHER CLEANING MATERIALS.

4.9.0 PLANT REMOVAL FROM MASONRY WALLS

PART 1 - GENERAL SUMMARY

This section deals with the plant removal on the structure itself. For the plant removal for the site please refer to the site section. Small shrubs and other plants growing on the structure cause physical damage. Their roots penetrate the joints between stones and within gaps in the stone itself. Therefore they must be removed. However, they must be removed very carefully to avoid further damage and the dislodging of original materials. Following is the procedure for the removal of this plant material.

ALL PLANTS, MOSSES, LICHENS & ALGAE TO BE REMOVED FROM THE SURFACES OF WALLS

PART 2 - MATERIALS

Hand tools and scaffolding, SAFETY EQUIPMENT, Herbicide and Biocide as mentioned in previous paragraphs and as approved by the Engineer.

PART 3 - EXECUTION

- 1) The plant should NOT be removed until structural consolidation of the area is ready to proceed. The team and materials should be ready to stabilize and consolidate the area immediately after the plant removal. By no means should a plant be removed and the area left overnight or over a weekend without stabilization. Work should progress just ahead of the structural stabilization.
- 2) The plant should be removed slowly and a determination made in the field if it can be removed safely without damage to the workers and/or structure. If the plant is supporting a stone block or any other material then the area must be stabilized before complete removal.

- 3) The plant must be completely removed with NO roots remaining.
- 4) All loose soil and friable materials must then be removed and the area cleaned according to the instructions for structural consolidation.
- 5) The area must be carefully inspected to ensure no remaining plant materials, mosses lichens or algae exist that could sprout again. The area must then be treated with an approved Herbicide and/or Biocide accordingly before consolidation and allowed to dry. Use herbicide/biocide as per Materials & Equipment. In areas where large plants exist a small quantity of quaternary ammonium salts or approved herbicide is to be injected in to the plant stem and roots so that when the plant dries it can be removed without damage to the fabric.

CAUTION: ALL HERBICIDES/BIOCIDES ARE TO BE USED CAREFULLY AND ALL PRECAUTIONS TO BE TAKEN REGARDING THE HEALTH AND SAFETY OF WORKERS. FOLLOW MANUFACTURERS INSTRUCTIONS

- 6) The area can then be structurally consolidated following the paragraph for mortar pointing.
- 7) ALL PLANTS ARE TO BE REMOVED and disposed of properly. The dead material cannot be left on the site. Dead materials can be temporarily stored on site during the removal but only for one week periods and not stored together to reduce the risk of fire. Every Friday the site must be cleared of dead plant materials.

4.9.2A MORTAR POINTING

NOTE: POINTING OF ALL MORTAR JOINTS AS DESIGNATED ON THE DRAWINGS

- A. Re-pointing is described as the process to remove and replace the last layer of joints between ashlar to a depth of 20mm and when done properly it restores the integrity and seals the wall.
- B. Pointing is described when applying mortar to a joint in masonry that has been lost. This includes filling the joint and then treating the surface with point mortar to match the existing surface.

This section covers both in the following way:

- 1) Where new stones are built or existing stones are re-set, filling the joints and pointing should be implemented according to this paragraph, but pricing should be included in the price of those works together with blending the pointing 0.50m around the repair area.

- 2) Where plants are removed joints will need pointing and this will be priced according to this paragraph 4.9.2A-B taking into account blending the pointing 0.50m around the repair area.
- 3) At the surface - elevations of all walls and parapets, where no stone repair or plant removal is carried out, but joints are empty these should be pointed according to this paragraph and priced according to 4.9.2A-B.
- 4) At the surface - elevations of all walls and parapets, where no stone repair or plant removal is carried out and where the joints are not empty, but pointing is deteriorated as described below, re-pointing is carried out and works should be priced according to this paragraph as 4.9.2A-A, taking into account blending the pointing 0.50m around the repair area
- 5) At areas on top of walls and parapets or where the core of the wall is exposed and where the surface is not covered by drainage works, repair of joints is important for the disposal of water and the structural connection. Additionally the wall will be crowned, where applicable, according to the details. These should also be included according to this paragraph as 4.9.2A-B.

CAUTION: SOME JOINTS AND AREAS CONTAIN HARDER PORTLAND CEMENT MORTAR OR OTHER HARD MORTAR MATERIALS. THIS MATERIAL IS NOT TO BE REMOVED. AN INSPECTION IS NECESSARY TO DETERMINE IF THE MORTAR CAN EASILY BE REMOVED. WHERE MORTAR CANNOT BE EASILY REMOVED IT IS TO REMAIN IN PLACE. CONSULT ENGINEER – SOME MORTAR MAY REMAIN IN PLACE AT ENGINEER’S DISCRETION.

PART 1 – GENERAL SUMMARY

The mortar joints between stones are some of the most vulnerable locations in the construction of a masonry wall. When the bond between the stone ashlar is lost it allows larger elements to become loose and allows the penetration of water and plants leading to further loss, deformations, cracks and loss of stability and safety. Therefore it is very important that these joints are repaired.

The objective is to match the historic mortar so that the new material will not conflict visually or physically with the original materials. It must match in color, texture, tooling, and sand content. It must also have less compressive strength than the surrounding stone material.

NOTE: IN AREAS OF THE TOP OF THE WALLS AND PARAPETS AND STONE ASHLAR REPLACEMENT, NEW BUILT OR RESET THE ENTIRE AREA MUST BE CLEANED AND POINTED AND THEN EXTEND THE WORK 0.5M AROUND THE PERIMETER TO ‘BLEND’ TO THE SURROUNDING AREA WHERE APPLICABLE. IN CASE OF LOCAL REPAIR OF JOINTS DUE TO HARD MATERIAL, RE-POINTING WORK TO EXTEND INTO SURROUNDING AREA A MINIMUM OF 0.50 METER ALL AROUND TO ‘BLEND’ INTO OTHER AREAS.

PART 2 – MATERIALS

As per mortar specifications, mason’s tools, clean potable water and natural bristle brushes, clean sand, stone ashlar to match existing.

PART 3 - EXECUTION

Following is the procedure for the removal of the loose or soft old pointing and the placement of a new mortar joint, as re-pointing, and the installation of a mortar into the joint and finish with mortar that has been completely lost, as pointing. This procedure includes guidance on raking out and re-pointing the deteriorated or inappropriately repaired horizontal and vertical joints on exterior stone. Deteriorated mortar includes the one which is excessively soft, crumbling, cracked, badly stained or missing. This procedure should be used in conjunction with other sections which describes in more detail the purpose of re-pointing in general, the materials such as mortar requirements and other precautions that should be taken. These guidelines should be reviewed prior to performing this procedure and should be followed, when applicable, along with supervision of the ENGINEER.

- 1) The formulation described elsewhere in this document must be strictly adhered to for the proper new material. All new materials must be checked for consistency, color, absence of salt, ingredients, texture, etc. Therefore the mix design of the mortar should be submitted and the mortar must be mixed in the presence of the ENGINEER, cured and mature, tested by an appropriate laboratory for its strength and water absorption and approved before it's used for application. Its compressive strength should be at least 5Mpa but less than the strength of the stone. Its water absorption should be as close as possible to the stone's one but worse, since the mortar should be the sacrificial material and not the stone. After its approval samples can again be tested randomly to be sure that same material is produced. Use potable water, free of salt and other organic materials.
- 2) Mixing of the mortar should be done very carefully in the presence of the ENGINEER. The dry ingredients should be measured by volume and thoroughly mixed before the addition of any water. DAMP sand must be added slowly to ensure the correct quantity. Half the required water should be added followed by a thorough mixing before adding the other half of water in small quantities while mixing. ONLY the amount of mortar to be used in a single area over the course of 2 hours should be mixed. The addition of large quantities of additional water to make the mortar 'workable' is not permitted.
- 3) The areas to be pointed (consolidated) and re-pointed are outlined in the drawings accompanying this document. If an area to be re-pointed is adjacent to an area that is not to be re-pointed then there will not be a sharp 'break'. The re-pointing must be 'blended' into the adjacent area as mentioned above.
- 4) A small test area must be created before the work begins using the same techniques, tools and workmanship. This sample application must be approved by the ENGINEER.
- 5) Before applying the re-pointing the area must be completely clean and clear of loose materials and debris including plant materials. This must be done with hand tools and brushes – NO electric or gas power tools or metal brushes may be used. The old, disintegrated loose mortar must be removed to the depth

where solid mortar or rubble core is encountered. Care must be taken to minimize any damage to original material.

- 6) Joint Raking: Cut out mortar from deteriorated joints by hand to depths that are required to expose sound, un weathered mortar.
- 7) The stones and original remaining mortar can be 'pre-wetted' or made damp just before the application of the new mortar. This is to ensure that the dry material does not absorb moisture too quickly from the new mortar.
- 8) Rinse masonry joint surfaces with water to remove any dust and mortar particles. Time application of rinsing so that, at time of pointing, excess water has evaporated or run off, and joint surfaces are damp but free of standing water.
- 9) Joint Pointing: Apply first layer of jointing mortar to areas where existing mortar is missing or was removed to depth greater than surrounding areas. Apply in layers not greater than 5cm until a uniform depth is formed. Compact each layer thoroughly and allow it to become thumbprint- hard before applying next layer.
- 10) The joint should be filled and compacted in the clean space between stones taking care not to add additional mortar to the face of the stone. This should be done by successively applying 1 -3 cm of material in 'stages' until the joint is filled. It is important to make sure that each layer is slightly hard as most of the shrinkage occurs in the first few minutes. The final layer should be slightly recessed to mark the application of new material. Periodic rewetting of the newly re-pointed area should be conducted as this will also prevent premature drying. After joints have been filled to a uniform depth, place remaining pointing mortar in layers to achieve proper installation and compaction. Fully compact each layer and allow becoming thumbprint hard before applying next layer. Take care not to spread mortar over edges onto exposed masonry surfaces, or to featheredge mortar. When mortar is thumbprint hard, tool to match original appearance of joints, unless otherwise indicated. Remove excess mortar from edge of joint by brushing. Cure mortar by maintaining in a damp condition for not less than 72 hours.
- 11) After the new mortar is dry cleaning the area is necessary. This can be done with a natural brush. No chemicals, electrical tools or metal brushes can be used. The new mortar must be completely dry before cleaning. Prevent grout or mortar used from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces. Protect sills, ledges, and projections from mortar droppings.
- 12) The area surrounding the area that has been re-pointed must be free and clear of all tools and materials after the works. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter using stiff nylon or bristle brushes and clean water, spray applied at low

pressure. Use only tools and equipment which are clean and free of hardened or partially hardened material. Use of metal scrapers or brushes will not be permitted. Clean sandstone only with fiber bristle brushes and water. Use no acids, detergents, or other chemical cleaning agents.

4.9.2.B STRUCTURAL CONSOLIDATION – COLLAPSED RETAINING WALL AT NORTHEAST GUN PLATFORM

PART 1 – GENERAL SUMMARY

Structural loss – collapsed retaining walls at the northeast gun platform - This easternmost gun platform has collapsed with the stones being washed down to the lower portions of the bastion. This has led to unstable remaining sections of the platform with several loose stones at the perimeter. This was most likely caused by poor water drainage and the position of the platform. Ponding of the water led to the deterioration of the lower courses and increased the lateral earth pressures on the wall resulting this way the collapse of a lower and an upper wall part and part of the platform. There are other walls at the top of the Cavalier in a critical condition as well.

SUBMITTALS:

Contractor must select an area to stabilize as a sample for the approval of the ENGINEER. Only after acceptance of this test area should the work proceed on other areas.

When cleaning, excavating and investigating to find the wall bases and lost stones, most probably the collapsed skylight will be revealed. Extra caution should be paid to coordinate with the museum and the Antiquities Department to monitor the works and close the museum for a few days in case debris or dust falls underneath in the museum though the shaft. Since work will be done close to the north curtain wall the contractor must take all safety measures so that the danger of workers losing their balance and falling or even material tripping, rolling and falling down the north side is completely eliminated. The contractor has to submit the methods and measures he will follow for approval by the Engineer.

PART 2 – MATERIALS

Wood scaffolding to prop up WALL as necessary at collapsed portions. Mortar and stones according to precedent specifications. Masons tools.

PART 3 - EXECUTION

- 1) Inspect area with ENGINEER. Clean the area beneath the existing remained platform and up to the north elevation of the curtain wall. Collect any fallen stones and create an inventory
- 2) Carefully excavate to find and then clean the remaining portions – bases and sides of the walls and prepare them for rebuilding. Consolidate the bases and

sides according to the paragraph of mortar pointing and replace or reset stones accordingly and following the specification and the approval of the Engineer. Mark the height and length of each wall and provide the sample for the approval of the Engineer. The Contractor's employed archaeologist, as specified in precedent paragraphs, should monitor excavation works

- 3) Reassemble stones on existing wall bases and build new stone ashlar as necessary to complete the walls to the approved height and length
- 4) Install 4" weep holes every 1 linear meter and 10cm above the lower surface to allow penetrating water to drain through. Use appropriate plastic pipes.
- 5) Use lime mortar and stone materials as per specifications.
- 6) Fill the joints on top of the new built walls to shed water away
- 7) Carefully backfill behind wall with clean soil compacting in lifts of 20-30 cm to achieve the heights approved for the lower level and the upper level, which is the base of the platform. Provide a 15cm thick and 20cm wide layer of gravel at the level of the weeping holes.
- 8) For the lower than the platform levels the work continuous with the application for drainage. For the upper level the work continuous with rebuilding the missing portion of the platform. The drainage of the lower levels to be prices elsewhere.
- 9) For the platform; reconstruct stone pavers as required to complete the gun platform. Use stone and mortar according to specifications. This includes cleaning of superficial existing earth, backfill and compact gravel to bring the base to the appropriate level. After the backfill of the wall has concluded certain part of the platform may still require some backfilling and compaction. The last layer (5-8cm) to be filled and compacted with fine gravel, build the lost stone pavement using new stones and fill the joints with mortar.

4.9.2.C STRUCTURAL CONSOLIDATION – DEFORMED CAVALIER WALL

PART 1 – GENERAL SUMMARY

This wall of the cavalier is significantly deformed most likely due to insufficient water drainage. It is approximately 40cm out of plumb and could collapse within the following years. Lack of rainwater management and disposal builds up lateral earth pressures and erodes the joints and stones of the wall. This causes deformations equivalent to collapse. This concerns the perimeter of the west up stand top of Cavalier's wall along the north east and again north part as marked on the drawings.

SUBMITTALS - Contractor should mark the area to be dismantled and submit method statement for this work for the Engineer's approval. After dismantling he must create a sample of the reassembly of the wall for the approval of the ENGINEER. Only after acceptance of this test area should the work proceed with rebuilding the wall.

PART 2 – MATERIALS

Wooden scaffolding to prop up WALL as necessary at collapsed or deformed portions to control dismantling. Use mortar and stone according to precedent specifications. Mason's tools.

PART 3 - EXECUTION

- 1) Inspect area with ENGINEER. DETERMINE WITH ENGINEER THE WIDTH AND HEIGHT OF THE WALL AREA THAT MUST BE DISMANTLED. Photograph wall before, during and after this process. Provide shoring made of wooden elements to support parts of the area and control dismantling and avoid uncontrolled falling of stones.
- 2) Carefully disassemble stones while removing backfill surcharge. Number the stones so that each one's place is recorded. Clean stones of mortar and prepare for reassembly. Consolidate remaining parts of the wall by filling joints according to specifications. The Contractor's employed archaeologist, as specified in precedent paragraphs, should monitor works
- 3) Reassemble stones in their original location; follow their numbering and build them in a plumb wall on the existing wall base and complete the wall to the original height. Ensure that the reassembled wall is plumb by using appropriate mason's strings - lines. Connect the new stones to the existing ones at remaining edges.
- 4) Install weep holes every 1 linear meter at base to allow water to drain through
- 5) Use lime mortar as per this specification.
- 6) Repair the joints on top of wall to shed water away from top of wall

- 7) Carefully backfill behind wall with clean soil compacting in lifts of 20-30 cm. achieve height to the appropriate level for the drainage works to follow. Refer to the drainage drawings and specifications.

4.9.2.D STRUCTURAL CONSOLIDATION – COLLAPSED PARAPET SOUTHERN CURTAIN WALL

PART 1 – GENERAL SUMMARY

This parapet, from the Ottoman period, has collapsed. While most of the parapet is extent, this section has fallen into the ditch and was removed probably during the ongoing works in the ditch. This section should be rebuilt as visitors approach the edge, and it is unsafe.

SUBMITTALS - Contractor to submit samples of stones and mortar as required by the specifications for the Engineer's approval. Additionally he must build a sample to be approved by the Engineer. Only after acceptance of this test area should the work proceed for completion. The work is to be carried out at the edge of the roof and over the south curtain wall. The contractor should submit the method he will use for the safety of workers and the area below for the Engineer's approval. This should include scaffolding from the Ditch's side with appropriate floors to block any material that may fall down.

PART 2 – MATERIALS

Mortar and stones according to the precedent specifications. Scaffolding. Mason's tools.

PART 3 - EXECUTION

- 1) Inspect area with ENGINEER. DETERMINE WITH ENGINEER the height of the finished parapet, which should match the height of the existing parapet on both sides.
- 2) Provide scaffolding for the safety of works and block the area below the parapet with safety and do not permit any work or workers below during this process.
- 3) Clean existing wall of loose mortar, debris and plants and repair the joints at the existing base and sides to receive the stone ashlar. Secure any loose stones by pointing with mortar according to specifications.
- 4) Install new stone ashlar following the same dimensions with the existing in place stones. Rebuild to original height. Fill the joints on top of parapet to block percolation of water into the joints.

- 5) Clean all scuppers in this area to permit the drainage of water from behind the parapet to the ditch.

4.9.2.E STRUCTURAL CONSOLIDATION OF SOUTH CURTAIN WALL

PART 1 – GENERAL SUMMARY

The South Curtain Wall suffers from stone deterioration and disintegration. There are a lot of recesses and important features such as loopholes or lower gun ports have almost been lost or deformed. However it's not the purpose of this specification and works to rebuild the surface of the south curtain wall but only to consolidate the surfaces and wall to improve its structural capacity and reduce further deterioration.

To consolidate the south wall several works have to be carried out that are covered by this specification in other paragraphs. In example grouting of cracks, building new ashlar at certain locations, removal of plants and pointing of empty joints, not repointing, are to be carried out for this wall. However there are areas where the loss of stone is heavy and the original form, although it exists at other parts of this wall, which suffer less damage, is not yet well known. For areas like these building of ashlar may not be wise. Building of rubble stone wall into courses and in a certain recess safe to allow completion of the wall's surface in the future may be more appropriate.

This paragraph concerns works for areas of the South Curtain Wall that should be built using rubble stone built into courses at recess from the probable finished face of the wall.

SUBMITTALS - Contractor to submit samples of stones and mortar as required by the specifications for the Engineer's approval. Additionally he must build a sample to be approved by the Engineer. Only after acceptance of the materials and sample should the work proceed for completion. There are similar examples built at other sections of the fortifications that have been completed and delivered. The contractor can inspect these areas together with the Engineer to have a better picture of what is expected.

PART 2 – MATERIALS

Mortar and stones according to the precedent specifications. Scaffolding. Mason's tools.

PART 3 - EXECUTION

- 1) Inspect wall with ENGINEER. DETERMINE WITH ENGINEER the areas to be build.
- 2) Provide necessary scaffolding and draw vertical and horizontal string lines for the probable finished face. Mark the recess of approximately 10 to 15cm, depending on the core's depth and the finish lines.
- 3) Clean the back surface from loose materials, stone and mortar fragments and clean with potable water. Clean and consolidate the base on top of which the wall will be built.
- 4) Use rubble roughly of 20cm diameter and start building from the sound base up. Form courses to follow the courses of adjacent area's ashlar to provide an

even but recessed stone built wall. Treat the joints as mentioned in precedent paragraphs.

4.9.5 STONE CLEANING - GENERAL

PART 1---GENERAL SUMMARY –Significant amounts of aging and weathering and thus cosmetic effect in sandstone is natural and acceptable and contributes to the monument’s character. Natural weathering and staining stone are not sufficient cause for cleaning. However, there are some areas that require cleaning from bird excrement, efflorescence, staining caused by biological growth (mosses, lichens, algae), by soot, coming from restaurants, and by application of whitewash. All these areas if cleaned will improve significantly the appearance of the monument. The cleaning of the fabric is not a necessarily a priority but recommended to remove unsightly distractions.

The stone of the Walls is very porous and prone to picking up dirt, dust, oils, and greases from both direct contact and from the atmosphere. The absorption of these kinds of contaminants can cause surface staining, and promote biological growth.

This work is to be carried out for surfaces of the north curtain wall, along the west side of the museum entrance, the east Cavalier – curtain wall, over the restaurants, part of the north – northeast wall of the Tower, where whitewash has been applied and part of the south and west elevation of Tower walls.

SUBMITTALS – test cleaning method in a non-visible area of each elevation mentioned above to establish the method necessary for each different type of staining. Take photographs before and after and once the method is concluded submit method, materials, tools and photographs for the Engineer’s approval.

PART 2 MATERIALS

Clean potable, salt free water, cold or warm, is to be used in hand operated spray equipment. Only soft natural fiber bristle brushes are allowed along with wooden spatulas or small trowels. Refer to other sections in this Technical Specification for plant removal. Do not use mechanical methods or strong tools that can damage the stone’s surface. Chipping off the skin of the stones is not permitted. Very low pressure water or sand-water blasting could be allowed under the condition that it causes no damage to the stone. To assure this the contractor must apply this not on the Monument but on to a stone same with the Monument’s stones and if succeeded then test on a small area of the Monument for verification. If staining cannot be removed with these methods then it will be cleaned as much as possible or not cleaned at all according to the Engineer’s instructions. To remove biological staining Herbicide/biocide as specified elsewhere in this specification should be used as per Engineer’s instructions and approval. In difficult cases that staining cannot be removed the contractor has to present a method statement from an experienced stone conservator for the approval of the Engineer.

CAUTION: CHEMICAL CLEANERS, BLEACH AND HIGH PRESSURE WASHERS ARE NOT PERMITTED. GENERALLY, THIS WORK SHOULD BE PERFORMED BY AN EXPERIENCED

CONTRACTOR. NO WIRE STIFF BRISTLES ARE ALLOWED AS THEY MAY LEAVE BEHIND BITS OF IRON, WHICH COULD RUST AND LEAVE STAINS ON THE SURFACE AND DAMAGE THE STONE'S SKIN

PART 3- EXECUTION

- 1) EXAMINATION – Inspect areas to be cleaned with the ENGINEER. Mark areas with Engineer to be cleaned **UNTIL AREA LISTED IN THE BILL OF QUANTITIES IS ACHIEVED**. Examine site conditions to determine that current area to be cleaned has already been structurally stabilized, re-pointed and all vegetation removed. Test cleaning on a small, inconspicuous area to check for adverse effects and damage to the material. Surface Preparation: Before proceeding with cleaning operations, remove all miscellaneous hardware, anchors and bird excrement from the surface to prevent any discoloration.

NOTE: BIRD EXCREMENT WILL LEAVE A PERMANENT DARK-COLORED STAIN that may be impossible to remove.

- 2) TEST CLEANING ON A SMALL AREA TO DETERMINE EFFECTIVENESS OF CLEANING METHODS, MATERIALS, EQUIPMENT BEFORE PROCEEDING WITH CLEANING OPERATIONS ON LARGER AREAS. ADJUST METHODS, MATERIALS, EQUIPMENT, PRESSURES, ETC. AS NECESSARY. DO NOT PROCEED UNTIL AN ACCEPTABLE CLEANING OPERATION HAS BEEN FULLY DOCUMENTED AND APPROVED.
- 3) CLEAN WALLS. This procedure includes guidance on cleaning selected areas of dirt-build-up on sandstone by LIGHTLY washing with clean water and soft natural bristle brushes. The requirements that must be taken into account to carry out the cleaning are:
 - a. Cleaning action must be slow enough to allow the operator to control effect.
 - b. The method used must not generate MATERIALS harmful to the conservation of the stone.
 - c. Cleaning method should not produce heavy abrasions, micro-fractures or changes on the surface of the stone.
 - d. The method of cleaning depends on: The nature of substances to remove. The characteristics of stone and its conservation status. The type of dirt, the extension, the thickness of the layer of dirt and its uniformity.
- 4) Given the nature of the stone and its conservation status, the monument must only be cleaned by hand with water and bristle brush slowly. This prevents the appearance of efflorescence. Only the necessary amount of water in a very pressure, probably hand pump, may be used. The remains of crusts can be eliminated with a brush. The amount of water to be used should be the

minimum possible. Rinse the surface thoroughly with clean, clear water using a hand pump and continue to flush the water across the surface. While surface is still wet brush with a soft, natural fiber bristle brush. If surface has begun to dry, re-wet before continuing and rinse the stone with clean, clear water again. Cover all areas to ensure an even cleaning of the stone. Begin at the top of the structure and continue to the bottom.

CAUTION: DON'T OVERLY CLEAN OR AGGRESSIVELY CLEAN THE STONE AS THIS WILL CAUSE A PREMATURE BREAKDOWN OF THE BONDING AGENTS WITHIN THE STONE.

DO NOT USE POWERED ROTARY BRUSHES. THESE ARE TOO HARSH AND MAY SEVERELY ABRASE THE SURFACE.

CAUTION: DO NOT USE ABRASIVE CLEANING METHODS. DO NOT USE ACIDIC OR ALKALI CHEMICAL CLEANERS. ALWAYS USE THE GENTLEST MEANS OF CLEANING POSSIBLE.

- 5) CRUMBLY SURFACES: Remove the flaking compound using wooden scrapers. Take care not to gouge or damage the stone. Remove as much as possible using stiff bristle brush. Small amounts of residual caulking compound may remain on the surface, and should be left.
- 6) For Loose Dirt and Dust: Wash the surface with water using a sprayer with a fine spray. Gently scrub as necessary with a wet natural bristle brush. Avoid soaking the stone. Rinse the surface thoroughly to prevent hazy or invisible residues which may attract dirt.
- 7) For Molds, Mosses, and Algae: Fungal/algal growth is fostered in environments high in moisture. This, combined with lack of sunlight, creates favorable conditions for this type of surface staining. Eliminate conditions of excess moisture. Carefully scrub the surface with a natural bristle brush and water and small wooden tools. Use the approved biocide first and leave it working for 30 minutes. Apply again in 1 hour and if persistent after another 2 hours depending on how persistent the case is. Grind as mentioned above and clean with water.
- 8) For Efflorescence and Surface Salts: Carefully dry-brush salts off the surface using a natural bristle brush or wash with warm water. If the efflorescence returns, carefully examine surrounding areas to determine the possibility of leaks or sources of water causing excess moisture infiltration. Eliminate sources of excess moisture and repeat.

4.9.6 REPAIR OF STONE BUILT PLATFORMS & FLOORS

PART 1---GENERAL SUMMARY

There are three stone build platforms on top of the Cavalier. The Towers roof surface is a stone built pavement and there is also a stone pavement along the Rampart and right next to the Cavalier's walls. These surfaces need repairs to keep the stones in place and conserve the pavements and to help the disposal of the water. The water falls on to these pavements and ponds and percolates through the joints in to the structure. this way the joints, if any remain exists, deteriorate the stones can be detached and the water eventually flows through capillary or gravity forces to the nearest surface and evaporated causing loss of stones and joints.

SUBMITTALS – Submit method statement and mortar samples for the Engineer's approval.

PART 2 MATERIALS

Mortar to be according to the specification. Clean potable, salt free water, special sad or dust color to obtain the appropriate color. Mason's tools, small hand tools for cleaning joints, buckets, carts and similar small equipment.

PART 3- EXECUTION

- 1) Inspect and marks the areas to be repaired with the ENGINEER. Carefully clean a sample area to define the procedure and submit method statement for the Engineer's approval. This sampling should be carried out for each separate area to define if the procedure shall be the same or different depending on the location of the pavement.
- 2) Clean the joints to an average depth of approximately 10cm. and remove excavated material away from site. Wash the area and take levels in combination with the drainage works described elsewhere in this specification. Submit the levels to the Engineer for approval.
- 3) Prepare mortar strengthened with the use of polypropylene fibers and fill the joints to the appropriate level. Treat the joints to obtain a smooth concaved surface on top and keep moist using burlap fabric for at least 4 days.
- 4) Monitor the surface and repair any hair cracks that may develop by using similar mortar material

05 DIVISION - METALS

5.1.1 SAFETY FENCE

PART 1 – GENERAL SUMMARY

This is located between the ramparts and the round tower of the bastion. This was installed to prevent visitors from accessing the tower roof. It is dangerously insecure. Visitors have been observed trying to climb this fence to access the tower roof. This fence is easily moved back and forth, and if anyone tries to bypass it he will most probably fall down to the Fosse.

SUBMITTALS – submit certificates of steel, paint and expansion anchor bolts to the Engineer for approval.

STANDARDS - CEN ISO/TR 15608:2013 (WI=00121626) Welding - Guidelines for a metallic materials; CEN ISO/TR 3834-6:2007 (WI=00121451) Quality requirements for fusion welding of metallic materials; EN 10238:2009 (WI=EC103050) Automatically blast-cleaned and automatically prefabrication primed structural steel products. EN 50059:1990 (WI=489) Specification for electrostatic hand-held spraying equipment. EN 82079-1:2012 (WI=23298) Preparation of instructions for use. EN ISO 11124-1:1997 (WI=00139092) Preparation of steel substrates before application of paints and related products. EN ISO 12944-1:1998 (WI=00139055) Paints and varnishes - Corrosion protection of steel structures by protective paint systems. EN ISO 12944-5:2007 (WI=00139169) Paints and varnishes - Corrosion protection of steel structures by protective paint systems, EN 1993:2005 – design of steel structures

PART 2 MATERIALS

Steel, corrosion protection, paints, anchors, drilling equipment to place anchors

PART 3- EXECUTION

- 1) Provide scaffolding for safety and remove existing safety fence. Remove anchors from surfaces. Patch the holes on the concrete structure – roof of the Museum using appropriate polymer cement non shrinking mortar of the Engineer's approval. Repair the stone joints according to the specification for removing metal fixtures.
- 2) Block off area for safety and do not permit work in this area until new safety fence is installed.
- 3) Submit detail designs to engineer for approval including mounting options.
- 4) Install new safety fence and paint using a painting system suitable for marine environment. The color to be approved by the Engineer. Especially for the paint, the Contractor should investigate the earliest for the available colors and submit the available options to the Engineer.

5.1.2 SAFETY BARS

PART 1 – GENERAL SUMMARY

The top of walls at the Cavalier, Tower and Rampart are accessible and these areas are dangerous since there is no safety fence around these areas. It is very unsightly and intrusive to provide fencing all around the top of walls. The way people can access these areas is to climb on the gun ports, which are relevantly low (a few decimetres high) and then easily climb on top of the walls. At one location at the easternmost area of the Cavalier there is even a stone built staircase leading on top of the wall to the area of the flagpoles and from there one can jump over the embrasures and access all the tops. At one location of the Tower a similar step has been provided to provide access near the light tower and from there one can again jump over the embrasures and access all the top of the Tower Walls. Similar conditions exist at the rampart top of walls, where the level of the stones at the gun ports is quite low. People can step up, walk toward the ottoman parapet, which is relevantly low and from there access the whole of the area near over the edge of the south curtain wall. Actually all parapets on top of the Rampart and Tower walls are low and there are no parapets on top of the Cavalier's walls.

The purpose of this paragraph is not to fill the place with safety fences but to provide safety bars as a line of protection, which will indicate to visitors that access beyond this line is not safe and must be avoided. These safety bars are to be placed in front of each and every gun port – embrasure so that visitors can understand that they should not pass beyond this and avoid climbing on the gun ports and then on to the tops.

SUBMITTALS – submit certificates of steel, paint and a sample installation to the Engineer for approval.

STANDARDS - CEN ISO/TR 15608:2013 (WI=00121626) Welding - Guidelines for a metallic materials; CEN ISO/TR 3834-6:2007 (WI=00121451) Quality requirements for fusion welding of metallic materials; EN 10238:2009 (WI=EC103050) Automatically blast-cleaned and automatically prefabrication primed structural steel products. EN 50059:1990 (WI=489) Specification for electrostatic hand-held spraying equipment. EN 82079-1:2012 (WI=23298) Preparation of instructions for use. EN ISO 11124-1:1997 (WI=00139092) Preparation of steel substrates before application of paints and related products. EN ISO 12944-1:1998 (WI=00139055) Paints and varnishes - Corrosion protection of steel structures by protective paint systems. EN ISO 12944-5:2007 (WI=00139169) Paints and varnishes - Corrosion protection of steel structures by protective paint systems, EN 1993:2005 – design of steel structures

PART 2 MATERIALS

Steel, corrosion protection, paints, anchors, drilling equipment to place anchors

PART 3- EXECUTION

- 1) Mark all the locations where the safety bars are to be provided, i.e in front of every gun port of the Cavalier's south and east perimeter, the Tower's perimeter and along the south Rampart's Venetian parapet and the east end of the rampart. These safety bars should be installed at the height of 110cm from the floor level.
- 2) They are made of CHS48.3X3 steel tubes (circular hollow section 2inches diameter and 3mm thickness). They must have continuously welded end plates at both ends. They have L shape steel plates welded at the bottom. These steel plates are 50mm wide and 6mm thick. They are welded at the bottom of the tube go down and then turn 90° to be inserted into the joint between the ashlar stones. Anchor the plates into the joints by removing the joint's mortar to a depth of at least 10cm, inserting the plate and fixing it using the approved mortar. The purpose of the plate going down is to take the fixing point to the joint's level. The 110cm from the floor most probably do not coincide with the level of a joint and perhaps the joint at one end is at different level than the joint at the other end of the safety bar. Consequently the levels should be measured and the safety bars prepared so that the plates match the joints to which they'll be fixed into.
- 3) Once measuring is finished submit details to the Engineer for approval.
- 4) After approval prepare, install, fix and paint. Especially for the paint, the Contractor should investigate the earliest for the available colors and submit the available options to the Engineer.

5.1.3 SAFETY HANDRAILS

PART 1 – GENERAL SUMMARY

These handrails are to be realized along the steps going from the parking area to the top of the Walls. These stairs are too narrow and without any protection. Easily a visitor may trip or lose his step and fall down. Since the steps are narrow the handrails are attached at the side into the joints of the stone built base of the steps. Some parts of the stairs, i.e. landings, are almost flat and following the tops of the stepping curtain walls. Along the sides of these locations safety fence is created according to the corresponding paragraph but its cost will be included in this paragraph to have a total cost for the protection along these steps-stairs.

SUBMITTALS – submit certificates of steel, paint and expansion anchor bolts to the Engineer for approval.

STANDARDS – Similar to the standards of the other safety fences and bars

PART 2 MATERIALS

Steel, corrosion protection, paints, anchors, cables, drilling equipment to place anchors.

PART 3- EXECUTION

- 1) Provide scaffolding for safety.
- 2) Mark the locations where the connections will take place.
- 3) Measure the heights and levels and prepare the detail drawings. Submit to the Engineer for approval, including mounting options.
- 4) Install new safety handrails, posts, cables, handrails made with tubes as described for safety bars and paint using a painting system suitable for marine environment. The color to be approved by the Engineer. Especially for the paint, the Contractor should investigate the earliest for the available colors and submit the available options to the Engineer.

06 DIVISION - WOOD

6.1.1 WOODEN BLOCKS

PART 1 – GENERAL SUMMARY

There are a few blocks embedded in the masonry, into ashlar or joints. These blocks have been in their location for long years, and they are part of the wall. They can be removed although it is expected to be difficult. Cracks have developed due to their long life, the many cycles of dry and humid environment they endured and eventually the loss of their natural moisture. Additionally, iron nails have been inserted, which corroded and swelled causing mechanical stress and eventually helped in the development of cracks. The corrosion of the iron nails has spread on the surface and in the body of these wooden elements. Macroscopically they were examined, and their conservation status was found to be in a fair condition

RETAIN THESE WOOD BLOCKS AND DO NOT REMOVE.

PART 2 – MATERIALS

Small hand tools to remove mortar around the wooden blocks, wood preservative to protect the wood from insects and weathering. Use acrylic resin like Paraloid B72 5% in acetone or equivalent

SUBMITTALS – submit certificates of wood preservative and resin to the Engineer for approval.

PART 3---EXECUTION

- 1) Inspect the wood blocks for rot, and drainage
- 2) Clean around all wood block and remove all mortar and portland cement.
- 3) Treat the wood block with the approved preservative and point around with approved lime mortar
- 4) Apply injections with the approved resin taking care so that the resin doesn't come in touch with the stones.

6.1.2 WOODEN SAFETY BARS

PART 1 – GENERAL SUMMARY

There are several wooden safety bars attached to the Tower's embrasures. These have deteriorated and some are ready to fall. Most of them have been attached to holes opened in the stones. They are located near the end of the embrasures and the height to which they were put doesn't provide safety. Some will have to be removed anyway to repair the deteriorated stone.

These wooden safety bars will be removed. the repair of the stones is included elsewhere.

PART 2 – MATERIALS

Small hand tools to remove the mortar used to fix these wooden bars and to cut and remove them.

PART 3---EXECUTION

- 1) Identify the wooden bars to be removed and submit method statement for the Engineer's approval.
- 2) Provide safety measures for the workers
- 3) Cut the wooden bars with a hand saw tool and then clean the mortar keeping the two ends into the stone and remove them.

07 DIVISION – MOISTURE PROTECTION

7.0.5 DRAINAGE SYSTEM AT THE BOTTOM OF THE MONUMENT

PART 1 – GENERAL SUMMARY

Along the bottom perimeter of the Monument hard material pavements are in touch with the walls. These don't allow the evaporation of water that comes in touch with the walls below. The water comes up as rising damp through capillary action and evaporates through the stone built walls causing erosion of joints and stones. These pavements are made of concrete and/or stone along the north side and additionally of asphalt along the east side.

These hard pavements are to be cut. The cut is included and priced in another paragraph of this specification. Cutting the pavements is not enough. Water washed down from the walls and tops and coming in touch with the walls from other sources below will concentrate and pond along these areas and then the result will be the same. To help the water evaporate and be carried away a system of gravel drainage trenches is crated along this perimeter.

The following two separate drainage system lines are provided:

- A) The first one extends along the North side from the Museum walls approximately from the west side of the entrance till the stairs of the parking area. This includes the trenches, several catch basins, it receives water coming from the top of the Bastion and then crosses the asphalt parking surface to go to the opposite island, where trees are located. All the line will be finished with gravel except the part crossing the parking, where the pipe will be protected with concrete at least 15cm thick and the asphalt surface will be repaired. At the island a portion of its surface around 15m² will be transformed to a gravel surface for evaporation and a percolation pit with a diameter of 1.0meter will be excavated to a depth of 1.0m below the evaporation pit's depth and also be filled with coarse gravel to provide an absorption pit and dispose the water to the ground.
- B) The second one extends along the east side from the corner of the Arsenal Gate it goes along the east Cavalier-curtain wall and around the Tower ending at the south area and to the Fosse. From this point the trench continuous to the evaporation/percolation pit provided at the west side of the Tower and south side of the South Curtain wall. Catch basins will be provided at both ends and along the line every 12m. the line will finish with gravel. Some of the surfaces along this line are covered with asphalt and stone pavement. These will be cut as mentioned above. Some are covered with earth. At the end of this line at the Fosse an evaporation/percolation pit with a surface of approximately 50m² is created. The pit will be covered with gravel and will have also an absorption pit filled with coarse gravel similar to the one mentioned for the first line.

The work is similar to the analogous system provided at the top of the Bastion but distances here are longer and excavations and other works are deeper. Additionally different safety measures should be taken since these works are located right next to road and parking areas and also the evaporation pits are included.

The Contractor's employed archaeologist, as specified in precedent paragraphs, should monitor excavation works

Pricing of the two lines must be separated. The first one shall include the works for the north line and be numbered as 7.0.5-A. The second one shall include the works for the east and south line and be numbered as 7.0.5-B.

SUBMITTALS - Submit sample section of perforated pipe, gravel and geotextile, pipes, precast concrete catch basin to Engineer. Product inspection and material data sheets of all materials.

STANDARDS – All geotextile must comply with EuroNorm EN 13252:2014 pipe MATERIALS and assemblies in accordance with the applicable part(s) of EuroNorm CEN/TS 13476-4:2013, EN 13476-1, EN 13476-2 and EN 13476-3, EN 1433:2002/AC:2004, precast concrete catch basin EN 206:2013, Cast iron grate is to be EuroNorm cast iron 1561:1997 EN 1253-1:2003 (WI=00165159)Guidelines for drainage EN 12502-1:2004 (WI=00262026) Protection of metallic materials against corrosion - Guidance on the assessment of corrosion likelihood in water distribution and storage systems; EN 933-5:1998 (WI=00154017) Tests for geometrical properties of aggregates

PART 2 – MATERIALS

Perforated PVC drain pipe shall be continuously perforated slotted with minimum openings of 2mm ON THE TOP AND SIDES ONLY with smooth interior with a minimum inside diameter of 15 cm. Gravel shall be 1cm – 3 cm uniformly graded coarse washed and clean and free of salt and dirt. Geotextile to be of synthetic polymer compound NONWOVEN with variable small openings of minimum size of .211 mm of #70 with a percent open area of 4% and with a tensile strength of 100kg., provided by a certified ISO 9001:2008 manufacturer and to be resistant to ultraviolet degradation and biological and chemical environments and salts. (Propex 401, Geosynthetics, BASF or equivalent) Rolls of geotextile shall be stored in vertical positions in staging area and protected from moisture, dirt, excessive heat and the sun until installation. Cover shall remain on the roll until use. Ensure proper cover upon installation and sufficient overlap. Precast concrete catch basin, gravel base, precast concrete catch basin, galvanized leaf screen fittings, iron grate.

IF pipe with slots on the top and sides only is not available then pipe with slots all around may be used PROVIDED the bottom the trench is modified to incorporate a solid base of lime concrete to block the holes at the bottom and up to the mid height of the pipe, permit positive drainage. The formation of the trenches should prevent the water from ponding inside the trench.

ALL MATERIALS WITH THEIR CERTIFICATES, THE METHOD STATEMENT AND A SAMPLE SHOULD BE SUBMITTED FOR THE APPROVAL OF THE ENGINEER.

PART 3 – EXECUTION

- 1) Implement protection for workers and work during the implementation of these works. Safety measures should include appropriate fencing, signs and flashing yellow lights battery operated. Workers should also wear appropriate vests and a person should monitor the area from traffic. Traffic will not be affected but in case someone wants to park along the working area he should be advised to move elsewhere.
- 2) Excavate the soil to the appropriate depth, starting from at least 40cm depth at starting points and forming the slope of 0.8 to 1% towards the ends.
- 3) Protect trench and surrounding area from any unfavorable event prior to installation. Install the drainage system after other site activities are complete to prevent damage from other activities. If other activities have to be carried out after the installation of the drainage system then it's the contractor's responsibility to protect its completed work not to be damaged and if it is damaged to repair according to the specifications and to the Engineer's approval.
- 4) The bottom of the trench should be uniform and level un-compacted subgrade free from rocks, debris and vegetation. Any work or removal of soil should be accomplished with hand tools and light excavators. Avoid use of heavy equipment and protect the walls from any possible damage.
- 5) Line the bottom and sides of the trench with geotextile with any overlaps of 0.5 (1/2) meters. Fold back edges at the trench's surface and secure with the final layer of gravel. Geotextile prevents fine soil and sand from entering and then clogging the drainage system thus extending the life of the drain system. Since the top of the trench will be covered with geotextile there is no need to provide additional cover over the pipe.
- 6) Line the bottom of the trench with gravel to adjust the slope created during the excavation and cover any recesses or inappropriate slopes. Install perforated drain pipe to slope specified for drainage between 0.8% - 1% and support throughout length with gravel underneath and to both sides. Connect lengths of pipe as per manufacturer's specifications. Ensure that gravel is on both sides of trench and pipe is clean and free of dirt and debris.
- 7) The foundation for the catch basin shall be constructed of compacted gravel and shall be a minimum thickness of 20 cm. The top of the precast concrete catch basin will be flushed with the top surface of the trench and will have a continuous notch formed for the receiving of a cast iron grate. The cast iron grate is to be fitted snugly into the formed top of the pit and is to have slotted openings of 3-5 cm and a minimum thickness of 5cm. A wire galvanized steel screen shall be placed over the drainage inlet pipe to prevent the passage of debris. Backfill shall be clean gravel as specified elsewhere in these specifications. The surface shall be graded and compacted so the surface slope is toward inlet. Upon completion each inlet or catch basin shall be thoroughly

cleaned of any accumulated silt or debris and shall be maintained free of such materials until acceptance of the work and system testing.

NOTE: TEST ENTIRE LENGTH OF PIPE AND CHANNEL FOR POSITIVE DRAINAGE BEFORE THE INSTALLING ANY ADDITIONAL GRAVEL OR COVER AND BACKFILLING TRENCH. ENGINEER MUST BE PRESENT DURING TESTING.

- 8) The slotted tube will be placed in the trench. Its installation will begin from a catch basin at the head of the collection system in the direction of the slope. The pipes will protrude into the catch basins as per the drawing details and mentioned above. The pipes will be laid at the abovementioned slope. Catch basins will be positioned at ALL changes of direction, connections and maximum every 12 to 15m in straight lines of the drainage system. The locations of these catch basins are shown on the drawings.
- 9) The trench will be filled with gravel as a filter material. The drains will conduct water to the evaporation pit to the end as shown on the drawings.
- 10) Construct evaporation/percolation pit at the end of the system to allow the disbursement of water as per drawings. The evaporation pit's plan dimensions are described above. Its depth should be at least 20cm below the level at the end of the drainage system's pipe. It is estimated that the depth of the north evaporation pit will be approximately 1.3m and that the depth of the southwest evaporation pit will be approximately 1.3m again although the length is longer, due to the fact that the level at the Fosse is lower than the starting point. Since this is an archaeological site conduct excavations carefully and with the presence of an archaeologist from the Responsible Authority. If anything is found then the Engineer will be promptly informed and the responsible archaeologist will take over accordingly.
- 11) The evaporation pits will be excavated to the appropriate depth and further to this depth an absorption pit approximately of 1.0m diameter will be excavated further down to help the disbursement of water. The depth of this pit should be at least another 1.0m. The absorption pit will be filled using coarse gravel up to the bottom of the evaporation pit. Geotextile will be used to cover the whole of the evaporation pit's bottom and sides. The evaporation pit will be filled using coarse gravel up to 20cm lower than the top level. The geotextile's ends will be folded back into the surface and spliced with geotextile to cover the top. The reason for covering the pit with geotextile is not to allow fine soil particles to filter down and block the evaporation/percolation procedure. The final layer on top will be made from fine gravel compacted, the color of which should be approved by the Engineer.

7.0.6 DRAINAGE SYSTEM'S SCUPPERS AND DRAIN PIPES

PART 1 – GENERAL SUMMARY

The drainage system provided on top has to dispose the water appropriately. There is no way to do so on top of the walls as this would eventually lead to percolation of water to the walls structure and cause erosion and deterioration. Consequently two

outlets are provided. The first one is at the end of the drainage system provided at the top and northwest side of the Rampart. This takes down the water from the Cavalier's and Rampart's surfaces. The second one takes down the water from the top of the Tower. Additionally a horizontal metal drainage channel with down spouts is provided to take the water dropping from the concrete spouts of the Museum's roof, at both sides, to the roof surface.

This paragraph includes all three cases but the pricing should be separated as follows:

- A) This is the first one as described above. The pipe starts from the end catch basin on top of the Rampart. An outlet pipe protrudes from the last catch basin out to a scupper and a drain pipe take the water down to the lower stepping wall. At that point a prefabricated connection part with an inspection cap is provided and the pipe continuous to the parking's drainage system entering the first catch basin. The parking's drainage system is described and priced elsewhere. The reference of these works is 7.0.6-A
- B) The second line takes the water from the open drain of the Tower's roof. At the end of this open drain there is already an exit point through the embrasure's wall. This opening is slightly higher than the end of the open drain. The works f this paragraph include the cleaning of this exit, lowering it to come to the level of the open drain and then putting a pipe to take the water from this end to the west elevation of the Tower. The pipe is provided so that water running through this opening doesn't wet the embrasure's walls. The face of the pipe at the roof will be covered around using lime mortar according to this specification. At the other end the pipe will be protruding slightly into to a scupper and from there to go almost straight down to the Fosse. At its lower end a catch basin and a gravel trench with a PVC not perforated pipe are created, as described elsewhere n this specification, to take the water to the evaporation pit. The reference for these works is 7.0.6-B
- C) The drainage channel with the down spouts for both sides of the Museum's roof. The reference for these works is 7.0.6-C

SUBMITTALS - Submit samples of materials, plastic pipes, cast iron pipes, and galvanized drainage channel and down spouts, and their connecting devises, scuppers, supporting devises, paints and method statement for the Engineer's approval.

STANDARDS – Applicable standards and mentioned elsewhere in this specification for similar woks, plus Euronorms related to cast iron pipes and galvanized pipes, connecting parts and supporting devises on buildings.

PART 2 – MATERIALS

PVC drain pipe suitable for drainage or sewerage installations 4" of diameter to be used for the Tower's outlet on top of the roof. Cast iron pipes 4" diameter for the Tower and 6" of diameter for the Rampart, 4" galvanized pipes and 15x15cm 2mm thick drainage channel, with their appropriate connecting parts and components. Scuppers made of cast iron as well. In case cast iron materials are not available the Engineer should be

promptly informed and use of same but galvanized materials may be permitted at the Engineer's approval. These are to be treated with appropriate undercoats and primers and finished with marine environment paints. All other materials have been described in preceding paragraphs.

ALL MATERIALS WITH THEIR CERTIFICATES, THE METHOD STATEMENT AND SAMPLES SHOULD BE SUBMITTED FOR THE APPROVAL OF THE ENGINEER.

PART 3 – EXECUTION

- 1) Implement safety measures for the protection for workers and work during the implementation. Appropriate scaffolding and fences should be provided
- 2) Investigate the Tower's existing outlet and lower and protect all its length and perimeter with mortar accordingly. Install pipe and connect to the existing open drain. Seal the pipe's end at both ends and provide tubes and grouting to fill the gaps around the pipe. Place one tube at the bottom of the interior and at the top of the exterior. This will facilitate the extraction of air and martyr the filling of the area.
- 3) Provide and connect the scupper and the down pipe. Connect the pipe to the bottom catch basin at the Fosse's level. Realize the trench with the plastic pipe to end to the evaporation pit.
- 4) Install the exit pipe from the end of the last catch basin on top of the Rampart at the west side on top. Provide and support the scupper. Install and support on the wall the pipe coming from the last catch basin of the parking's drainage system to the top scupper.
- 5) Treat and paint the scupper and pipes.
- 6) Test the functioning of the system in the presence of the Engineer.
- 7) Provide the drain channel on the Museum's roof perimeter and connect with the down pipes as shown on the relevant layout detail. Connect channel and pipes using appropriate connecting devices of the Engineer's approval. Trear and paint channel and down pipes.
- 8) Especially for the paints suitable for marine environment, the Contractor should investigate the earliest for the available colors and submit the available options to the Engineer.

08 DIVISION - DOORS & WINDOWS

8.6.3 SKYLIGHTS

PART 1 – GENERAL SUMMARY

There are currently three vertical shafts from the roof of the Bastion into the interior and down to the Museum's area. They are now blocked with steel reinforced concrete skylights that are failing. In addition these shafts were to function as chimneys and provide light into the interior of the gate. Therefore the concrete caps require removal and replacement with a metal frame and glass skylight. This will provide light and air into the interior.

The removal is covered in a separate paragraph of this specification.

SUBMITTALS: Measured shop drawings created for fabrication of the metal frame, mounting hardware and glass mounts. Steel certifications, priming paint and finish paint certifications to be appropriate for marine environment. Glass and sealant certifications. Sample welds and bolts, seals as required by the ENGINEER.

STANDARDS - CEN ISO/TR 15608:2013 (WI=00121626) Welding - Guidelines for a metallic materials; CEN ISO/TR 3834-6:2007 (WI=00121451) Quality requirements for fusion welding of metallic materials; EN 10238:2009 (WI=EC103050) Automatically blast-cleaned and automatically prefabrication primed structural steel products Euronorm standard for primer, paint, laminated safety glass, welds, bolts, etc. EN 13022-1:2014 (WI=00129191) Glass in building - Structural sealant glazing EN15274:2007 (WI=00193174) General purpose adhesives for structural assembly - Requirements and test methods. EN 15434:2006+A1:2010 (WI=00349019) Glass in building - Product standard for structural and/or ultra-violet resistant sealant (for use with structural sealant glazing and/or insulating glass units with exposed seals)

PART 2 – MATERIALS

Structural steel frame with laminated safety glass and mounting hardware. Clear silicon sealant to secure the glass to frame. Structural silicone sealant to be Dow CorningR TSSA – Transparent Structural Silicone Adhesive or equal, clear, transparent high strength adhesive for fixed frameless glazing. 1.3MPa dynamic design stress. 0.6 MPa dead load design stress. Keep tubes of silicone refrigerated below +5 degrees until read for application. Adhesive bead to be continuous and applied as per manufacturer's recommendations.

PART 3 – EXECUTION

- 1) Verify all dimensions and mounting points before the fabrication of the skylight frame. Submit shop drawings for approval.

- 2) Repoint all surrounding masonry and ensure that all stone ashlar are stable before mounting skylight. Repointing of skylight's parapets should be included in the pricing of this paragraph.
- 3) Ensure all steel is protected from rust with a minimum of two coats of protective primer and a final finish coat. Coatings should be appropriate for marine environment. Especially for the paint, the Contractor should investigate the earliest for the available colors and submit the available options to the Engineer.
- 4) Remove temporary blocked openings. Observe all safety precautions.

DURING INSTALLATION BLOCK ALL ACCESS WITH SAFETY TAPE TO THE SPACE BELOW AND POST AN INSPECTOR TO PREVENT ACCESS BELOW FROM EITHER SIDE.

- 5) Ensure there are no scratches and touch up any exposed portions of the steel frame.

09 DIVISION - FINISHES

NOT USED

10 DIVISION - SPECIALITIES

10.4.5 VISITOR INFORMATION PANEL

PART 1 GENERAL SUMMARY

After the conservation intervention of the Bastion it will be open to visitors. Therefore it is necessary to inform them of the monument. This is done for dissemination of information. This section deals with information display panels to be placed in certain locations as per the drawings. They can be prefabricated off site and installed. These information panels are designed to be placed on site and removable.

SUBMITTALS - A prototype must be constructed for approval by the ENGINEER. Submit shop drawings for approval.

STANDARDS - CEN ISO/TR 15608:2013 (WI=00121626) Welding - Guidelines for a metallic materials; CEN ISO/TR 3834-6:2007 (WI=00121451) Quality requirements for fusion welding of metallic materials; EN 10238:2009 (WI=EC103050) Specification for electrostatic hand-held spraying equipment. EN 82079-1:2012 (WI=23298) Preparation of instructions for use. EN ISO 11124-1:1997 (WI=00139092) Preparation of steel substrates before application of paints and related products. EN ISO 12944-1:1998 (WI=00139055) EN ISO 12944-5:2007 (WI=00139169) Paints and varnishes - Corrosion protection of steel structures by protective paint systems

PART 2- MATERIALS

Only marine primer and paint to be used for all metal work, steel for the panel and tempered glass or polycarbonate for the cover. Silicon sealant to weatherproof the information display panel.

PART 3- EXECUTION

- 1) This information panel can be prefabricated and welded off site and installed in such a way to be easily removable in the future. It is to be constructed of bar and sheet steel and covered with tempered glass and sealed with silicon.
- 2) Protected with sufficient marine primer and then two coats of flat black marine rust-inhibiting paint sufficiently to prevent corrosion. The frame is to be stabilized laterally with stainless steel cables, eye bolts and turnbuckles for tensioning. It is to be bolted to a precast concrete base as per the drawings.
- 3) Install the angled explanatory panel at a 45 degree angle are to be installed on the horizontal bar as per drawings and instructions for locations by ENGINEER. The entire assembly is to be customized for each space and to be sized with 15 cm between the assembly and the surrounding walls.
- 4) All shop fabrication work, marking, delivery, unloading, hoisting, erecting and fixing as per detail drawings. Welding is deemed to be in accordance with the specifications and for the material to be used. Gusset plates, shoe plates, end caps, cleats, brackets, stiffeners, bolts to be included in the rate of the

associated steel work. All welds are to be 6mm thick fillet weld and allowance for rolling margin. Grind to a smooth finish. Machine drilled bolt, holes nuts washers, cleats shoe and gusset plates and all other connections. After fabrication wire brush to clean all steel surfaces and paint with two coats of quick drying metal primer zinc phosphate and two coats of matt anti corrosive with necessary accessories.

- 5) Install the display panel with information provided by the ENGINEER and place the tempered glass on top and seal with silicon.

11 DIVISION - EQUIPMENT

NOT USED

12 DIVISION - FURNISHINGS

NOT USED

13 DIVISION - SPECIAL CONSTRUCTION

NOT USED

14 DIVISION - SCAFFOLDING

14.8.0 SCAFFOLDING

THIS SECTION STATES THE ERECTION, USE, ALTERNATION AND DISMANTLING OF TEMPORARY ELEVATED WORK AREAS, LADDERS AND SCAFFOLDS. THIS ONLY COVERS THE FABRICATED TUBE FRAME AND COUPLER SYSTEM. OTHER TYPES OF SCAFFOLDING SYSTEMS ARE NOT ALLOWED. THE USE OF SHORE OR LEAN-TO SCAFFOLDS IS STRICTLY PROHIBITED.

ALL SCAFFOLDS MUST BE ERECTED IN ACCORDANCE WITH ALL LOCAL LAWS AND SAFETY REQUIREMENTS. ALL PERMISSIONS FROM RELEVANT AUTHORITIES MUST BE OBTAINED BEFORE ERECTING SCAFFOLDING.

HEALTH & SAFETY OFFICER OF THE CONTRACTOR IS RESPONSIBLE AND LIABLE FOR THE PROPER INSTALLATION AND MAINTENANCE AND THEREAFTER REMOVAL OF THE SCAFFOLDS DURING THE WORKS.

UNIT PRICES ENTERED BY THE CONTRACTOR MUST BE INCLUSIVE OF COST OF INSTALLING, MAINTAINING AND REMOVING OF THE SCAFFOLDS.

HEALTH & SAFETY PLAN MUST BE SUBMITTED BEFORE THE WORKS START.

15 DIVISION - MECHANICAL

NOT USED

16 DIVISION - ELECTRICAL

16.4.0 ELECTRICAL CABLES ON MASONRY

ELECTRICAL CABLES ON MASONRY AND TOWER'S ROOF ARE NOT TO BE CHANGED OR ALTERED. THEY HAVE TO BE PROTECTED AT ALL TIMES. IF THEY HAVE TO BE REMOVED TEMPORARY THEN A LICENSED ELECTRICAL SUBCONTRACTOR SHOULD BE HIRED TO DO ALL NECESSARY WORKS.

THE SUBCONTRACTORS INFORMATION AND LICENSE TO BE SUBMITTED FOR THE ENGINEER'S APPROVAL.

ALL WORKS SHOULD BE CARRIED OUT ACCORDING TO LOCAL REGULATIONS AND APPROVED BY THE RESPONSIBLE AUTHORITY

16.5.3 EMERGENCY LIGHTING

PART 1 - GENERAL SUMMARY

This section concerns the installation of emergency lights operated by motion sensors on top of the Bastion. This includes 1) marking of the means of egress and 2) Illumination of the means of egress with emergency lighting.

It is possible that groups of people may congregate on top of the Bastion therefore emergency egress is necessary and required, but since this depends on the presence of people decision was made to provide motion sensors to activate these lights. It is assumed that electric power will be taken from the Museum in coordination with the responsible Authority.

- 1) Means of egress – the possible entry and exit points on top of the Bastion are through the stairs from the parking area and from the top of the walls approaching from the west. Consequently at least some lights should be provided along these areas. One probably on the north wall to provide light toward the stairs and one on top of the Cavalier's west wall to provide light at this area of approach.
- 2) Further people will be on top of the Cavalier and should be able to have minimum light to be able to detect safety fences and the exit. At least three lights should be provided on top of the Cavalier's walls to provide light to this area.
- 3) In a similar way people may access the Rampart toward the Museum roof. This "road" way should have minimum light, consequently three lights should be

provided, two on the Cavalier's walls and one on the Museum's roof to serve this purpose.

- 4) Although no access to the Tower's roof is realized in this scope, still people may access the area. Two lights should be provided on the Museum' roof to provide minimum light on this area.

QUALITY CONTROL – Installation of all conduit, wiring, connections and panels must be done by a licensed electrician with no less than 6 years' experience working under master electrician's supervision.

SUBMITTALS – supply emergency egress system design and diagram to the ENGINEER for approval. Coordination with the installation of the electrical system is required. Submit samples and manufactures' data sheets for lighting and motion sensors, conduit and wiring.

STANDARDS – EN 60598-2-22:1998 /A1:2003 (WI=6226) Luminaires Particular requirements - Luminaires for emergency lighting. EN 60598-2-22:2014 (WI=24274) Luminaires Particular requirements - Luminaires for emergency lighting EN 60598-2-12:2006 (WI=16778) Luminaires - Part 2-12: Particular requirements. EN 60598-2-12:2013 (WI=23960) Luminaires - Part 2-12: Particular requirements - Mains socket-outlet. EN 62595-2:2013 (WI=23637) LCD backlight unit. EN 62034:2012 (WI=22974) Automatic test systems for battery powered emergency escape lighting

PART 2 - MATERIALS

Emergency and egress LED lights, mounting hardware, hand tools, ladders, conduit and wire as per electrical distribution specification' s defined by the Local Responsible Authority. Lights shall have their separate distribution board and test switch and from this point manual operation should be also provided.

PART 3 - EXECUTION

- 1) Mark locations of all lights and mountings accessories and switch locations for approval by the ENGINEER.
- 2) Luminaires shall be mounted at the instructions of the ENGINEER. And tested for proper illumination of exit and approach areas as well as the areas mentioned above.
- 3) Install conduit as per the specifications and requirements of the Responsible Authority. The contractor is responsible for the proper inspection during installation. No conduits shall be installed on the surfaces of stone. Any mounting hardware for the conduit or lights must be in the mortar joint. If mortar joint requires repointing and repair then this is considered part of this task.

ALL EXPOSED CONDUIT SHALL BE GALVANIZED METAL – NO EXPOSED PVC.

- 4) Test entire system including battery backups.

