TECHNICAL SPECIFICATIONS

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1 Technical Specifications

1.1 General

A. All work is to be executed in accordance to drawings, specifications, manufacturer specifications, proposed materials and supervision.

B. Any discrepancies on drawings details, specification should be given in writing to the Architect and Civil Engineer for clarifications. The T.S. will be considered prevalent in the case of discrepancies between drawings, T.S. and BOQ.

C. Performance certificate of good work to be given for all materials used by the supplier and the contractor to UNDP prior to completion of works. All specialist material to be used must be done under the supplier supervision.

D. All references to and descriptions containing trade names, materials and procedures shall be deemed to include the phrase "or other equal and approved".

E. The works shall be designed, manufactured, delivered and applied in accordance with the latest revisions of the relevant sections / parts of the appropriate norms and standards.

F. All materials, components and methods of workmanship are to be of the best quality consistent with the character of the works. All components are to be no lesser standard than those contained in the appropriate current standards specifications referred to in this specification. The quality of workmanship shall not be less than that set out in the latest appropriate Code of Practices or Trade Association guidance documents.

G. Where local practice is such that an alternative material or quality of material to that specified is generally accepted, then the Engineer's approval must first be obtained before such alternative will be permitted to be used.

H. Branded materials are to be handled, stored, and used, and processes are to be carried out, strictly in accordance with the manufacturer's instructions and recommendations.

I. All materials, components and workmanship are to be in accordance with good building practice.

J. Samples of all materials shall be submitted for the approval of the Engineer.

K. Except where otherwise stated or contradicted, workmanship is to comply with British Standard Codes of Practice where applicable and in particular to BS 8000.

L. Workmanship is to be of a high standard throughout, particularly with regard to the accuracy of dimensions, lines, planes, levels and the quality of surface textures.

M. The Contractor is to do everything necessary to ensure that the standard of finish which is hereby demanded by this contract is achieved.

N. Any specification, plan, drawing or any other documents issued by or on behalf of the Engineer for the purposes of the contract shall remain the property of the Engineer and must be returned on completion of the Contract.

O. The Contractor and his sub-contractors and suppliers shall not communicate with representatives of the general and technical press, radio, television or any other communications media about the contract, without the prior approval of the Engineer.

P. The Contractor shall co-ordinate and submit to the Engineer for review all the fabrication and installation drawings including builder's work details from sub-contractors, suppliers and statutory undertakers. The Contractor shall agree and be responsible for the positions of chases, holes, pockets, mortices, fixings, sleeves, pipes, cast-in elements, and the like before work is put in hand to ensure that there is no conflict with other work.

Q. Commodities specified to conform to Standards shall be clearly and indelibly marked with the reference specified. Where this is impracticable the relevant advice/delivery notes shall

include the Standard reference with which they are to comply. The Contractor shall provide certificates of compliance with Standards when required by the Engineer.

R. The Contractor shall at all stages before any work is commenced check dimensions and levels shown on all documents for compatibility with each other, with the Site and work completed to date including the documents of any sub-contractor. The Contractor shall accept full and sole responsibility for the accuracy of all dimensions and levels and any discrepancies relating to the Works as constructed.

S. The Contractor shall construct the Works in a manner which fully accords with the Design in all respects. All commodities shall be of new manufacture unless otherwise stated.

2 Particular Technical Specifications

2.1 PART A: Intervention Scheme

2.1.1 General

The technical specifications given in this document refer to technical works for the rehabilitation and conservation of the Sourp Magar Monastery (hereafter referred to as the Monastery or the Monument) located in Halevga/Alevkayasi. The specifications are to be read in conjunction with the drawings and the bills of quantities. In case the Contractor identifies any inconsistencies between the aforementioned documents, he/she must inform in due time the Engineer so as to obtain instructions on how to proceed.

2.1.2 Preliminary works

2.1.2.1 Site preparation

Prior to the initiation of any works, the Contractor must **install a 2 m high fence** made out of metal sheets along the entire perimeter of the building plot's boundaries to **define the work-site area**. The fence structure shall **incorporate appropriate signage** in accordance to the requirements of current building regulations. Signs will be placed at the entrance and other visible places of the work-site giving instructions for the safety of the workers and all of those visiting the site.

The Contractor must identify and indicate the **areas where the storage of building materials and equipment shall take** and the **areas where debris or other disposal material produced in the course of the construction works shall be deposited**. These areas shall be located within the boundaries of the building plot and in any case within the area of the work-site. The areas proposed by the Contractor are subject to the approval of the Engineer who may suggest alternative positions. Debris or other disposal materials shall be gathered in skips and will be taken away from the site during the procedure of the works. The skip will be replaced with empty ones when full. Disposal must be made to an approved disposal site.

Scaffolding will be required to facilitate works in height, both at the interior and the exterior parts of the structure. Only working scaffolds capable of providing safe working areas with safe access suitable for the work being done are acceptable. For this purpose, steel tube framed scaffolding designed in accordance to EN 12811-1 and meeting the safety requirements of current building regulations shall be used. Scaffold must be sound, rigid and sufficient to carry its own weight plus four times the maximum intended load without settling or displacement. It must be erected on solid footing. Unstable objects, such as barrels, boxes, loose bricks or concrete blocks must not be used to support scaffolds or planks. Any scaffolding members which are expected to be supported or be in contact with the historic fabric (including the footings) must **incorporate appropriate guarding** (e.g. foam protectors) to preclude inducing scuffs, scrapes or other damage. Scaffold platforms must be tightly planked with scaffold plank grade material or equivalent.

Any planks or other installations forming working platforms supported on scaffolding shall have no gaps between them, while continuous railings and toe-boards shall be provided to ensure safety. The scaffolds should be covered with high density UV resistant polyethylene nets in order to avert accidents associated to falling items or height dizziness incidents of working people. Safe access to and communication between all levels of the scaffolds shall be achieved by means of steady ladders and/or stairways. Special provision should be made for the installation of equipment for the lifting and depositing materials, as well as for power and water supplies. Scaffold accessories such as braces, brackets, trusses, screw legs or ladders that are damaged or weakened from any cause must be immediately repaired or replaced. Prior to the installation of scaffolding the Contractor must **provide appropriate documentation (i.e. plans and method statement) indicating the exact positions where scaffolding will be placed, its layout and the measures that will be implemented on site to minimize the risk of causing damage of historic fabric**. This documentation submitted by the Contractor shall be examined by the Engineer, the consent of whom is required for proceeding with the installation of scaffolding.

2.1.2.2 Selection of materials

The Contractor must **provide specifications and samples of all materials** that will be used in the framework of the project, subject to the approval of the supervising Architect and Civil Engineer. All specifications submitted by the Contractor must be in English. In cases where specifications do not exist, the Contractor shall **carry out standardized tests to prove that the selected materials meet the requirements set** in the relevant specifications. The test reports shall be submitted to the supervising Architect and Civil Engineer, the consent of whom is required for the use of the proposed materials. Any test reports submitted by the Contractor must be in English.

2.1.2.3 Identification and marking of work areas

Prior to the initiation of works, the Contractor must **identify and mark the areas where the different works hereafter specified shall be implemented**. Work cannot commence, unless the identified areas are inspected and agreed with the supervising Architect and Civil Engineer.

2.1.2.4 Site measurements

The Contractor is responsible for carrying out **site measurements to ensure that any of the installations specified in the construction drawings and/or the technical specifications are indeed appropriate**. In case the measurements taken indicate that site conditions at the time of the project hinder the implementation of any of the specified installations, the Contractor must inform the supervising Architect and Civil Engineer, so as to obtain instructions on how to proceed.

2.1.2.5 Sample preparation and trial applications

Whereby specified hereafter, the Contractor has the **obligation to prepare samples and to perform trial applications of materials** so as to exhibit that the technical quality of works is appropriate and that the selected materials do not have any undesired effects on the historic fabric. The samples and the trial applications shall be inspected by the supervising Architect and Civil Engineer, the approval of whom is required before proceeding with any relevant intervention.

2.1.3 Protection of historic fabric

Certain works that will be carried out may potentially affect the historic fabric of the monument. The following issues are hereby identified: (i) the general cleaning of spaces may potentially result to loss of artifacts which are of historic or other value and are currently lying within the building spaces along with debris and (ii) interventions concerning the treatment of areas currently covered by render/plaster coatings may result to unacceptable loss of historic fabric. It is hereby noted that any

removal of historic parts of the monument (plasters, renders, timber beams etc.) without prior approval from qualified specialists, consent of the Client and proper documentation cannot be accepted in any case, since it will result in loosing historic and archaeological evidences.

To address the aforementioned issues the **Contractor must obtain throughout the duration of the project the services of a qualified Archeologist and a qualified Conservator**, both of whom must be approved by the Engineer.

The term qualified Archeologist refers to a competent individual with the following skills:

- Archeology degree (bachelor)
- Minimum 5 years of post-graduate experience in archeology
- At least 2 projects that involved 'investigation and/or conservation of medieval monuments'

The term qualified Conservator refers to a competent individual with the following skills:

- Conservation degree (bachelor)
- Minimum 5 years of post-graduate experience in 'conservation of historical masonry materials'
- At least 2 projects that involved 'conservation of historic renders/plasters' and 1 project that involved 'conservation of building stones'

It is hereby specified that **no cleaning or other work shall be conducted on any historic parts without the prior approval of the Conservator and Archaeologist**.

The role of the Archeologist will be will be (i) to supervise the general cleaning of areas ensuring that any items removed are not of historic value, (ii) to supervise the handling and transferring of elements of historic value recovered during any of the construction works hereby specified (iii) to supervise excavation works is these are deemed necessary in the course of the project for the implementation of the specified tasks (e.g. replacement of existing drainage trench installations if these are found to be damaged).
The role of the Conservator will be (i) to re-assess the condition of the render/coatings on all parts of the monuments and to establish in coordination with the supervising Architect and Engineer the implementation of measures for the protection of historic coatings and (ii) to supervise and if necessary undertake works concerning the consolidation and repair of areas covered by historic plaster/render coatings.

During the cleaning of areas the Archeologist shall be physically present in the site and shall supervise the implementation of works. During the removal of items from the areas of the Monastery the Archeologist must identify and record any items that are of historic or other value and must hence be stored. Any removal of debris, waste materials, handling and transferring of elements of historic value must be done in the presence of the Archaeologist and with his/her prior approval. When cleaning works take place, the Archeologist must submit to both the Client and the supervising Architect and Engineer a written report on a daily basis. This report must include detailed information on the areas cleaned, the materials/items discarded and any heritage asset which have been identified and must be complemented by photographic documentation. Likewise, in case the implementation of excavations is deemed necessary in the course of the project, the Archeologist shall be physically present in the site during the works and shall supervise and document their execution. When excavation works take place, the Archeologist must again submit to both the Client and the Engineer a written report on a daily basis. This report must include detailed information on the areas excavated and on any findings detected and must be complemented by photographic documentation.

Prior to the initiation of any works, and after the cleaning of all areas and the installation of means for accessing all sections of the structures (i.e. scaffolding), the Contractor's Conservator shall carry out a **full inspection of the monument to identify any parts of historic plaster/render coatings that need to be preserved**. The outcome of this inspection should inspection will be a report that will be presented to both the Client and the supervising Architect and Civil Engineer and will include the following:

- Identification of all areas where historic plaster/render coatings that need to be preserved exist
- Condition assessment of historic plaster/render coatings at the time of the survey
- Proposed measures for the protection of the historic plaster/render coatings, in case such action is required based on the works hereby specified

If deemed necessary, the Contractor may receive instructions by the supervising Architect and Civil Engineer on additional measures for the protection and conservation of existing coatings. In any case, interventions will not commence unless a detailed assessment of the historic plaster/render coatings is performed and the Client and the supervising Architect and Civil Engineer are adequately informed and give their consent.

During the execution of any works involving the treatment of areas covered by coatings the Conservator shall be physically present in the site and shall supervise or undertake works on the coatings, as instructed by the supervising Architect and Civil Engineer. When such works take place, the Conservator must submit to both the Client and the supervising Architect and Engineer a written report on a daily basis. This report must include detailed information on the areas treated and the methods applied and must be complemented by photographic documentation.

2.1.4 Documentation

The Contractor is **responsible for keeping detailed documentation of all works carried out on site**. The documentation shall include the following:

- Regularly filled construction site diary
- Photographic record
- 'As Built' drawings

The Contractor must keep the aforementioned documentation records at the site and make them accessible to the supervising Architect and Civil Engineer in order to facilitate inspection of works. After completion of the project, the Contactor has the obligation to submit to the Client both the photographic record and a complete set of 'As Built' drawings.

2.1.5 Repair method selection criteria

The method that shall be adopted for the repair of certain types of damage shall depend on the criteria quoted in

Table 1. Particular repair criteria apply for (a) treatment of decayed/deteriorated and/or heavily damaged stone, (b) repair of masonry cracks, (c) treatment of timber members and (d) repair of plaster/render mortars. The Contractor has the responsibility to mark and document (both in photographic and in drawing documentation) all points where the works listed in Table 1 shall be applied. The Contractor must submit this documentation along with the intended intervention method to the supervising Architect and Civil Engineer and must obtain their consent for proceeding with the execution of the works. The Contractor must also submit the documentation along with the list of interventions approved by the supervising Architect and Civil Engineer to the supervising Quantity Surveyor in order to facilitate monitoring of the works.

Table 1: Repair method selection criteria to be applied in the framework of the conservation project.

Issue	**Criteria**	**Repair method**
Treatment of decayed/deteriorated and/or heavily damaged stone	• Stone block exhibits cracking that does not extent throughout its height/length and/or • Stone material loss is ≤ 40% of the block's volume	The block should be retained and any visible cracks shall be filled with pointing mortar using the procedure described in *S6. Repointing of masonry*
	• Stone material loss is > 40% but ≤ 65% of the block's volume	The block should be retained. The deteriorated exterior face shall be cut out and the damaged area shall be patched with rendering mortar of colour and texture similar to that of the stone material. For the application of the patch mortar refer to *S20. Repair of render/plaster masonry coatings*
	• Stone block exhibits fracturing that extents throughout its height/length and/or • Stone material loss is > 65% of the block's volume	Replace damage block as per *S7. Reconstruction of masonry*
Repair of masonry cracks	• Crack mouth opening ≤ 3 mm and • Crack does not extend in depth > 40 mm form the face of the masonry	Filling with pointing mortar as per *S6. Repointing of masonry*
	• Crack mouth opening ≤ 15 mm	Perform grout injections as per *S11. Consolidation and repair of masonry by means of grout injections*
	• Crack mouth opening > 15 mm and/or • Voids extending into the core of the masonry and/or • Through cracks extending along the entire thickness of the masonry section	Local reconstruction as per *S7. Reconstruction of masonry*
Treatment of timber members	• Member does not suffer from fracturing or deflection >	Retain the element and perform in situ treatment as per *S5. Treatment of timber sections*

	length/100 and has not lost > 10% of its cross-section	
	• Member exhibits fracturing and/or • Member exhibits signs of rot and/or insect infestation which have resulted to loss of > 10% of cross-sectional area and/or • Member exhibits deflection > length/100	The element should be replaced For lintel elements refer to *S4. Repair of damaged lintels* For beam elements refer to *S14. Replacement of damaged timber beams*
Repair of plaster/render mortars	• The coating exhibits surface staining from organic agents	Preserve the original coating and perform surface cleaning as per *S2. Control of organic growth*
	• Sections of the coating are missing	Preserve the original coating and perform patch repairs using compatible mortar as per *S20. Repair of plaster/ render masonry coatings*
	• Sections of the coating have lost adhesion to the substrate and their collapse is imminent	Removal of damaged sections as per *S3. Removal of plaster/ render coatings* Restoration as per *S20. Repair of plaster/ render masonry coatings*

2.1.6 Description of Intervention Schemes

Block A constitutes the southwest part of the Monastic complex and consists of a series of single storey rooms. The structure currently lacks roofing and exhibits damage induced by failure of the timber lintels incorporated in the masonry walls and by the action of moisture. The plaster/render coatings of the masonry are in rather poor state suffering from extensive cracking and/or loss of adhesion to the masonry substrate, while parts of the walls have been rendered with incompatible cementitious plaster. The floors and walls are affected by surface organic growths and vegetation.
The interventions implemented in Block A shall aim to repair existing damage and to consolidate the historic fabric, preserving the structures in an unroofed state. The intervention scheme includes general cleaning of the building spaces and measures for the control of organic growth (i.e. removal of growing vegetation from masonry sections and cleaning of surfaces from mosses/lichens). Existing cementitious coatings, as well as other plaster/render materials which have lost adhesion to the masonry, shall be removed. Any timber lintels which exhibit defections/cracking/decay shall be replaced and partially collapsed areas shall be reconstructed. Timber elements that are in useable state will be retained and will be treated in situ. The structures also incorporate concrete lintels above certain openings which shall be repaired using an appropriate treatment for reinforcement corrosion and restoration of the cover material. Masonry cracks/fissures detected after the extraction of vegetation from the walls and the removal of coatings shall be repaired by means of grouting or stitching (i.e. localized reconstruction), depending on their extent. Repointing of the masonry shall be carried out throughout Block A, particularly to areas where the joints have weathered away. Along the upper part of all walls a capping layer shall be constructed to prevent

seepage of water. To protect the historic floor material from storm water and to prevent vegetation growth form the ground, the floor shall be completely covered with layers of granular material. These layers shall be placed in a manner so as to create inclinations enabling the drainage of water through existing door openings.
Provisionally, and in accordance to the instructions given by the Client, works carried out in Block A may include the addition of purposely-made timber frames within all exterior openings for supporting the masonry and for limiting visitor access.
The works to be carried out in Block A are summarized in Table 2. When preparing the workplan for the implementation of the intervention scheme, the Contractor shall consider that Table 2 lists the specified works in the order that they are intended to be carried out. The implementation of an alternative work plan is permitted as long as the Contractor informs the supervising Architect and Civil Engineer and obtains their consent. For each work listed in Table 2, reference is made to the corresponding technical specification hereafter presented in this document

Table 2: List of specified works (in order these are intended to be carried out) to be implemented in Block A with reference to the relevant technical specifications hereafter given.

Block A		
Specified works		
A/A	**Work description**	**Relevant technical specification**
AS1.	General cleaning	S1. Cleaning of areas
AS2.	Cleaning of floors from organic growth	S2. Control of organic growth
AS3.	Removal of organic growth from masonry	S2. Control of organic growth
AS4.	Removal of cementitious and deteriorated plasters	S3. Removal of plaster/ render coatings
AS5.	Replacement of damaged timber lintels	S4. Repair of damaged lintels
AS6.	Repair of damaged concrete lintel	S9. Treatment of reinforced concrete sections
AS7.	Reconstruction of partially collapsed masonry sections	S7. Reconstruction of masonry
AS8.	Repair of cracks by means of repointing, grout injection and/or localized masonry reconstruction*	S6. Repointing of masonry S7. Reconstruction of masonry S11. Consolidation and repair of masonry by means of grout injections
AS9.	In situ treatment of remaining timber members	S5. Treatment of timber sections
AS10.	Construction of capping layer on the upper part of all walls	S8. Construction of capping layer
AS11.	Repointing of masonry throughout	S6. Repointing of masonry
AS12.	Complete covering of floors with layers of granular materials and formation of ground drainage inclinations	S12. Covering of floors with granular material
AS13.	Addition of timber enclosures at the south openings	S24. Timber enclosures

*Depending on any damage observed during the execution of works

Block B is located at the south side of the Monastery's perimeter and consists of single-storey rooms. The rooms of Block B have been renovated rather recently and have been roofed with dual-pitched roofs with clay tile covering and perimeter parapet gables. The structures do not exhibit severe structural damage and their overall conservation state is better, compared to the other parts of the monument.
The interventions implemented in Block B shall aim to restore the appearance of the building surfaces and to repair any damage noted at the building components during the execution of works. The intervention scheme includes repair of plaster/render coatings and the repainting of the walls. In addition, the contractor shall inspect the roof and the rainwater drainage system of the building to re-assess its condition and in case any damage is recorded this shall be repaired.

The works to be carried out in Block B are summarized in Table 3. The Table lists the specified works in the order that they are intended to be carried out. For each work reference is made to the corresponding technical specification hereafter presented in this document

Table 3: List of specified works (in order these are intended to be carried out) to be implemented in Block G with reference to the relevant technical specifications hereafter given.

Block B		
Specified works		
A/A	**Work description**	**Relevant technical specification**
BS1.	General cleaning	S1. Cleaning of areas
BS2.	Repair of damaged plaster/ render coatings	S20. Repair of plaster/ render masonry coatings
BS3.	Painting of interior walls	S13. Painting of coatings
BS4.	Inspection and maintenance of the roof	S27. Maintenance of drainage systems
BS5.	Provision of access for the completion of survey	S29. Completion of Survey and Detailed Documentation
BS6.	Maintenance of existing doors and windows	S30. Maintenance of existing doors and windows

*Depending on any damage observed during the execution of works

Block C is a longitudinal two-storied building which constitutes the east wing of the Monastery. The structures of this part are currently unroofed and exhibit severe structural damage which includes separation of orthogonal walls, masonry cracking induced by vegetation growth, failure of timber floor structures and moisture-driven deterioration of masonry materials. Floor overlays are heavily cracked and their collapse is imminent due to damage of the timber beams supporting them, while sections of the walls' plasters/renders have lost adhesion to the masonry substrate. Due to the absence of a roof diaphragm structure, parts of the longitudinal walls are currently unrestrained, and thus susceptible to seismic damage. Moreover, Block C incorporates concrete slab structures which have been affected by reinforcement corrosion and show spalling.

The interventions implemented in Block C shall primarily aim to (i) stabilize the load-bearing system so as to reduce the risk of structural failure, (ii) consolidate the historic fabric and (iii) provide protection against water infiltration. The main entrance to Block C shall become the visitors' access point to the monument. General cleaning of building spaces shall take place, while all areas shall be cleaned from organic growths (i.e. of plants growing within the mass of building elements and of mosses, lichens and/or algae surface depositions). Plaster/render materials which have lost adhesion

to the masonry and are in danger of collapse, shall be removed to minimize the risk of visitor injuries. Any masonry cracks/fissures detected after the extraction of vegetation from the walls and the removal of coatings shall be repaired by means of pointing, grouting or stitching (i.e. localized reconstruction), depending on their extent. Limited reconstruction of partially collapsed areas shall be carried out to ensure stability of building sections. All loose/damaged floor overlays shall be removed, and damaged timber beams shall be replaced to restore the bearer elements at the floor level. Timber elements that are in operational condition will be retained and will be treated in situ. For the treatment of separation cracking at wall intersections, grout injections shall be undertaken, along with installation of post-tension steel ties. Further stabilization of the structure will be achieved via the installation of a temporary steel truss frame structure. The latter will be anchored to the longitudinal walls. Repointing of the masonry shall be carried out throughout Block C, particularly to areas where the joints have weathered away. The existing concrete balcony attached to the exterior of the eastern façade wall shall be removed. The existing concrete slab above the north section of Block C that faces towards the center of the Monastery shall be repaired and retained. To protect the spaces of Block C from the accumulation of storm water, existing floors shall be covered with layers of granular materials that will form drainage inclinations. Along the upper part of all walls a capping layer shall be constructed to prevent seepage of water. Interventions at the main entrance of Block C will be implemented to establish this point as the main access point to the monument. For this purpose, ramps will be added to facilitate disabled access. The entrance will also serve to drain water sheds. This shall be achieved via the installation of purposely made drainage cannels. Particular reference is hereby made to the partially collapsed kitchen structure at the northwest corner of Block C. The intention in this case will be to implement first aid consolidation measures (i.e. removal of organic growths, cleaning, crack repairs, repointing, capping) that will enhance the resistance of the remaining masonry sections against weathering and static loading. This is because there is no adequate historic information that would enable reconstruction of the collapsed sections in order to restore structural continuity, while the geometry of the missing sections cannot be envisaged from the remaining parts. It is noted that this area will not be accessible to visitors, as the kitchen structure will remain vulnerable to seismic damage even after consolidation. Provisionally, and based on the instructions given by the Client, purposely made steel installations may be added to block access to the ground floor and arcade and to limit visitors' movement only along the entrance pathway.

The works to be carried out in Block C are summarized in Table 4. When preparing the workplan for the implementation of the intervention scheme, the Contractor shall consider that Table 4 lists the specified works in the order that they are intended to be carried out. The implementation of an alternative workplan is permitted as long as the Contractor informs the supervising Architect and Civil Engineer and obtains their consent. For each work listed in Table 4, reference is made to the corresponding technical specification hereafter presented in this document.

Table 4: List of specified works (in order these are intended to be carried out) to be implemented in Block C with reference to the relevant technical specifications hereafter given.

Block C		
Specified works		
A/A	**Work description**	**Relevant technical specification**
CS1.	General cleaning	S1. Cleaning of areas
CS2.	Removal of deteriorated plaster sections	S3. Removal of plaster/ render coatings
CS3.	Removal of organic growth from the masonry	S2. Control of organic growth

CS4.	Replacement of damaged timber beams of the floor (including removal of all floor overlays)	S14. Replacement of damaged timber beams
CS5.	In situ treatment of remaining timber members	S5. Treatment of timber sections
CS6.	Installation of steel tie rods along the length of the transversal walls to connect the longitudinal walls of the structure	S17. Installation of steel tie rods
CS7.	Removal of concrete balcony on the east façade wall	S25. Removal of existing concrete sections
CS8.	Addition of steel truss frame structure to retain lateral movement of unrestrained sections of the façade wall	S18. Construction of steel structures
CS9.	Reconstruction of partially collapsed masonry sections	S7. Reconstruction of masonry
CS10.	Repair of cracks by means of repointing, grout injection and/or localized masonry reconstruction*	S6. Repointing of masonry S7. Reconstruction of masonry S11. Consolidation and repair of masonry by means of grout injections
CS11.	Repair of existing concrete slab	S9. Treatment of reinforced concrete sections
CS12.	Repointing of masonry throughout	S6. Repointing of masonry
CS13.	Construction of capping layer on the upper part of all walls	S8. Construction of capping layer
CS14.	~~Installation of drainage channels along the main entrance~~ CANCELLED	~~S16. Installation of drainage channels~~ CANCELLED
CS15.	Complete covering of floors with layers of granular materials and formation of ground drainage inclinations	S12. Covering of floors with granular material
CS16.	Addition of ramp on the entrance for disabled access	S12. Covering of floors with granular material
CS17.	Addition of timber enclosures at the east openings	S24. Timber enclosures
CS18.	Installation of temporary structures for survey completion	S29. Completion of survey and detailed documentation
CS19.	Addition of steel enclosures	S23. Steel enclosures
CS20.	Removal of concrete tread	S25. Removal of existing concrete sections

*Depending on any damage observed during the execution of works

Block D is located on the northern central part of the Monastery and consists of small-sized vaulted cells built on two different elevations. At the lower level, two adjacent rooms are constructed next to the north-east side of Block C and their floor is at the same level as that of the arched portico of Block C. The other parts belonging to Block D are constructed at a level > 4.5 m higher and are just above the roof of the vaulted chapel of Block E. The north-east corner of the rooms located at the higher level has collapsed, while the rooms at the lower level accommodate a significant amount of discarded materials. Moreover, the masonry joints in some parts of the structures have weathered away.

Works for the conservation of the vaulted cells of Block D are intended to restore structural integrity and to consolidate the masonry. Specified works focus on the repair of existing damage, the repointing of the masonry and the waterproofing of the roof structures. During the cleaning of the building spaces, particular emphasis shall be given on the protection and appropriate storage on any historic material pieces found within the rooms located at the lower elevation level. Sections of the masonry affected by partial collapse shall be reconstructed. Any cracks/fissures noted during the execution of works must be repaired using pointing mortar, injection grouting or stitching (i.e. localized reconstruction), depending on the extent of damage observed. The masonry joints shall be repointed throughout in order to establish adequate cohesion among the rubble stone blocks and enhance resistance against moisture infiltration. The exterior surface of the vaulted roof of the cells located at the higher elevation level shall be covered with a layer of mesh reinforced render and shall be waterproofed using a compatible cement-free compound.

The works to be carried out in Block D are summarized in Table 5. When preparing the workplan for the implementation of the intervention scheme, the Contractor shall consider that Table 5 lists the specified works in the order that they are intended to be carried out. The implementation of an alternative workplan is permitted as long as the Contractor informs the supervising Architect and Civil Engineer and obtains their consent. For each work listed in Table 5, reference is made to the corresponding technical specification hereafter presented in this document.

Table 5: List of specified works (in order these are intended to be carried out) to be implemented in Block D with reference to the relevant technical specifications hereafter given.

Block D		
Specified works		
A/A	**Work description**	**Relevant technical specification**
DS1.	General cleaning	S1. Cleaning of areas
DS2.	Reconstruction of partially collapsed masonry sections	S7. Reconstruction of masonry
DS3.	Repair of cracks by means of repointing, grout injection and/or localized masonry reconstruction*	S6. Repointing of masonry S7. Reconstruction of masonry S11. Consolidation and repair of masonry by means of grout injections
DS4.	Repointing of masonry throughout	S6. Repointing of masonry
DS5.	Waterproofing of the exterior surface of the cells' masonry vault roof using compatible cement free material	S19. Waterproofing of stone masonry surfaces

*Depending on any damage observed during the execution of works

Block E is a single-nave chapel with a pointed barrel vault roof and a semicircular apse, located at the northern central part of the Monastery. At its interior the structure incorporates plaster coatings of historic value, parts of which suffer from soiling due to organic surface depositions and sections of which are missing. The interior floor has missing tiles, while pieces belonging to a broken historic baptistery are currently stored in the chapel. At the exterior of the structure, some wall sections are affected by vegetation growing within the mass of the masonry. The vaulted roof has a cementitious exterior coating which exhibits some cracking.

The interventions implemented in Block E will aim at the rehabilitation of the chapel so that this may become accessible to visitors and have functional use. Specified works focus on the repair of existing damage, the consolidation of the historic fabric and the waterproofing of the roof structure. Regarding the cleaning of the building spaces, particular emphasis shall be given on the protection and appropriate storage on any historic material pieces found within Block E. The repair and conservation of the historic coatings shall be carried out under the supervision, or by a qualified Conservator as hereby specified. Works for the conservation of the plasters include cleaning of surfaces from organic depositions and patching of coating areas with compatible lime-based plaster. Works for the conservation of the Baptistery include reconstruction of the damaged concrete parts, repair of the concrete cornice currently kept within the chapel and placement to its original position. The repairs to be conducted to the interior floor of the chapel involve the filling of missing floor tiles with a light grey cement mixture as hereafter specified. Removal of growing vegetation from masonry sections shall be followed by repair of the resulting cracks/fissures using pointing mortar, injection grouting or stitching (i.e. localized reconstruction), depending on the extent of damage observed. For the repair of the vaulted roof's exterior cementitious coating, the works specified include filling of existing cracks and waterproofing of this surface with a suitable cement-based compound. To control visitor access and enable restoring functional use, steel and timber enclosures shall be installed on the door and window openings of the chapels as indicated in the relevant construction drawings.

The works to be carried out in Block E are summarized in Table 6. When preparing the workplan for the implementation of the intervention scheme, the Contractor shall consider that Table 6 lists the specified works in the order that they are intended to be carried out. The implementation of an alternative workplan is permitted as long as the Contractor informs the supervising Architect and Civil Engineer and obtains their consent. For each work listed in Table 6, reference is made to the corresponding technical specification hereafter presented in this document.

Table 6: List of specified works (in order these are intended to be carried out) to be implemented in Block E with reference to the relevant technical specifications hereafter given.

Block E		
Specified works		
A/A	**Work description**	**Relevant technical specification**
ES1.	General cleaning	S1. Cleaning of areas
ES2.	Cleaning of masonry and plaster surfaces from organic growth*	S2. Control of organic growth
ES3.	Repair of cracks by means of repointing, grout injection and/or localized masonry reconstruction**	S6. Repointing of masonry S7. Reconstruction of masonry S11. Consolidation and repair of masonry by means of grout injections
ES4.	Addition of steel enclosure at the window opening	S23. Steel enclosures
ES5.	Addition of timber enclosures at the door and window openings	S24. Timber enclosures
ES6.	Repair and waterproofing of the exterior cementitious coating of the vaulted roof	S21. Repair and waterproofing of cementitious coatings
ES7.	Repair of plaster coatings*	S20. Repair of plaster/ render masonry coatings
ES8.	Repplacement of missing floor tiles with similar decorated tiles	S22. Consolidation of historic floors

ES9.	Reconstruction of the Baptistery	S9. Treatment of reinforced concrete sections

*To be carried out under the supervision or by a qualified Conservator as hereby specified
**Depending on damage observed after extraction of organic growths and removal of coatings

Block F is a chapel structure built adjacently to the vaulted chapel of Block E, in the north-east part of the Monastery's central courtyard. It incorporates a rectangular nave with a semicircular apse and a concrete belfry and a narthex room with an arched doorway. The structure currently lacks roofing and suffers from uncontrolled vegetation growth, as well as from moisture-driven decay. The concrete frame of the belfry has been affected by reinforcement corrosion and exhibits spalling/delamination of the concrete cover. The coatings' surfaces exhibit soiling due to surface depositions of organic growths, while in certain areas the coatings have lost adhesion to the masonry substrate and their collapse is imminent. Voids are visible on the intrados of the arched passage to the narthex, while there are signs of unsuccessful attempts for the implementation of grout injections. Moreover, cracking has been noted in certain sections and in many areas the jointing mortar has weathered away from the face of the masonry.

The interventions implemented in Block F shall aim to repair existing damage and to consolidate the historic fabric, preserving the structure in an unroofed state. The intervention scheme includes general cleaning of the building spaces and measures for the control of organic growth (i.e. removal of growing vegetation from masonry sections and cleaning of surfaces from mosses/lichens). Since Block F will be accessible to visitors, any particularly loose coating materials that have lost adherence to the masonry and are in danger of collapse shall be removed to minimize the risk of injuries. Recorded cracking damage, as well as any cracks/fissures detected after the extraction of vegetation from the walls and the removal of coating sections shall be repaired by means of pointing, grouting or stitching (i.e. localized reconstruction), depending on their extent. Grout injections for the homogenization of the masonry shall be carried out on the wall that incorporates the arched entrance to the narthex. Repointing of the masonry shall be carried out throughout the exposed stonework of Block F, particularly to areas where the joints have weathered away. Along the upper part of all walls a capping layer shall be constructed to prevent seepage of water. The structure of the concrete belfry shall be repaired using an appropriate treatment for reinforcement corrosion and restoration of the cover material.
Provisionally, and in accordance to the instructions given by the Client, works carried out in Block F may include the addition of purposely-made steel gate at the arched entrance of the narthex.

The works to be carried out in Block F are summarized in Table 7. When preparing the workplan for the implementation of the intervention scheme, the Contractor shall consider that Table 7 lists the specified works in the order that they are intended to be carried out. The implementation of an alternative workplan is permitted as long as the Contractor informs the supervising Architect and Civil Engineer and obtains their consent. For each work listed in Table 7, reference is made to the corresponding technical specification hereafter presented in this document

Table 7: List of specified works (in order these are intended to be carried out) to be implemented in Block F with reference to the relevant technical specifications hereafter given.

Block F		
Specified works		
A/A	**Work description**	**Relevant technical specification**
FS1.	General cleaning	S1. Cleaning of areas
FS2.	Removal of plaster sections that are in danger of collapse	S3. Removal of plaster/ render coatings

FS3.	Removal of organic growth from the floors and the masonry	S2. Control of organic growth
FS4.	Repair of cracks by means of repointing, grout injection and/or localized masonry reconstruction*	S6. Repointing of masonry S7. Reconstruction of masonry S11. Consolidation and repair of masonry by means of grout injections
FS5.	Consolidation of masonry arched section by means of grout injection	S11. Consolidation and repair of masonry by means of grout injections
FS6.	Repointing of masonry throughout	S6. Repointing of masonry
FS7.	Repair of concrete belfry frame	S9. Treatment of reinforced concrete sections
FS8.	Construction of capping layer on the upper part of all walls	S8. Construction of capping layer
FS9.	Replacement of missing floor tiles with similar decorated tiles	S22. Consolidation of historic floors
Provisional works		
FP1.	Addition of steel gate enclosure at the arched opening	S23. Steel enclosures

*Depending on any damage observed during the execution of works

Block G extends along the south and north-south wings of the Monastery. It includes a perimeter wall that features a decorated doorway at the central part of the south side. It also includes an unroofed structure of rectangular layout that is built at a lower elevation level at the north-south part of the Monastery's courtyard. At present, many of the masonry walls of Block G are subject to the penetration of moisture due to the absence of roofing protection, while damage caused by uncontrolled vegetation growth is observed in some parts of the structures. The steel lintel above the doorway of Block G suffers from extensive corrosion. Partial collapses due to failure of timber lintels have also been recorded.

The intervention scheme to be implemented in Block G aims at the repair of existing damage, the consolidation of the masonry and preservation of the structures at their present state (i.e. unroofed). Works include cleaning of areas, removal of organic growths and local reconstruction of partially collapsed areas. Any cracks/fissures noted during the execution of works must be repaired using pointing mortar, injection grouting or stitching (i.e. localized reconstruction), depending on the extent of damage observed. The masonry joints shall be repointed throughout in order to establish adequate cohesion among the rubble stone blocks and enhance resistance against moisture infiltration. Furthermore, the rusted lintel of the decorated doorway shall be replaced. Works concerning the repair of timber lintels will also be carried out, while any timber members found to be in good condition at the time of the works shall be treated in situ and preserved. As a short-term measure for stopping water penetration at the top of the walls, a capping/flaunching layer will be constructed along the upper sections of the masonry.

The works to be carried out in Block G are summarized in Table 8. When preparing the workplan for the implementation of the intervention scheme, the Contractor shall consider that Table 8 lists the specified works in the order that they are intended to be carried out. The implementation of an alternative workplan is permitted as long as the Contractor informs the supervising Architect and Civil Engineer and obtains their consent. For each work listed in Table 8, reference is made to the corresponding technical specification hereafter presented in this document.

Table 8: List of specified works (in order these are intended to be carried out) to be implemented in Block G with reference to the relevant technical specifications hereafter given.

Block G		
Specified works		
A/A	**Work description**	**Relevant technical specification**
GS1.	General cleaning	S1. Cleaning of areas
GS2.	Removal of organic growth from masonry	S2. Control of organic growth
GS3.	Repair of cracks by means of repointing, grout injection and/or localized masonry reconstruction*	S6. Repointing of masonry S7. Reconstruction of masonry S11. Consolidation and repair of masonry by means of grout injections
GS4.	Replacement of damaged timber and steel lintels	S4. Repair of damaged lintels
GS5.	In situ treatment of remaining timber members	S5. Treatment of timber sections
GS6.	Repointing of masonry throughout	S6. Repointing of masonry
GS7.	Construction of capping layer on the upper part of all walls	S8. Construction of capping layer
GS8.	Addition of steel enclosure at the main west entrance opening	S23. Steel enclosures

*Depending on any damage observed during the execution of works

Maintenance works will also be carried out at the **Courtyard** area of the Monastery. These include the cleaning of the exterior spaces from debris, the removal of vegetation and the pruning of trees. Existing drainage channels shall be cleaned and inspected. In addition, an access ramp will be constructed and balustrading will be installed to facilitate the entry and accessibility to monastic complex. The works to be carried out in Block G are summarized in Table 9.

Table 9: List of specified works (in order these are intended to be carried out) to be implemented in the Courtyard area with reference to the relevant technical specifications hereafter given.

Courtyard		
A/A	**Specified works**	**Relevant Technical Specification**
YS1.	General cleaning	S1. Cleaning of areas
YS2.	Pruning of trees	S26. Gardening works
YS3.	Replacement of steel supporting structures for vines	S18. Construction of steel structures
YS4.	Cleaning and maintenance of the existing drainage system	S27. Maintenance of drainage systems
YS5.	Replacement of well cap	S27. Maintenance of drainage systems
YS6.	Installation of steel balustrading for guiding and limiting visitors' accessibility	S18. Construction of steel structures
YS7.	Addition of ramp at the south boundary of the plot for disabled access	S28. Concrete work

*Depending on any damage observed during the execution of works

2.2 PART B: Technical Description of Works

2.2.1 [S1] CLEANING OF AREAS

2.2.1.1 Scope and application

Cleaning of areas refers to the removal of all elements within the working areas that may impair the implementation of intervention works. This includes:
(1) **removal of all debris and waste materials**
(2) **collection and sorting of collapsed or temporarily stored building materials/elements**
(3) **cutting of woody vegetation and weeds growing at the interior of building spaces**.

The aforementioned works should be carried out throughout the Monastery.

2.2.1.2 Methodology

All **debris and waste materials** found on site:
1. S**hall be collected** and deposited in areas outside the Monastery building, but within the boundaries of the building plot.
2. T**o be transferred away for disposal**.
3. Building materials or other **elements of historic value** that are found on site (e.g. building stones, carved elements, inscriptions, etc.) **shall be carefully collected, placed on palettes and transferred to storage areas that will be specified by the Client**.
It is highlighted that the **cleaning of areas shall be done in the presence and under the supervision of a qualified Archeologist** as hereby specified.

The Archeologist shall:
3a. Inspect all items removed from the building spaces. Any removal of debris, waste materials, handling and transferring of elements of historic value must be done in the presence of the Archaeologist and with his/her prior approval.
3b. Identify and record any items that are of historic or other value.
3c. Items of historic and other value must be stored in-situ location specified by the Client.
3d. Appropriate documentation of the cleaning process should be kept. For this purpose, throughout the duration of the cleaning works hereby specified, the Archaeologist must submit to both the Client and the supervising Architect and Engineer:

- **A written report on a daily basis**. This report must include detailed information on the areas cleaned, the materials/items discarded and any heritage asset which have been identified.
- **Photographic documentation**.

4. Any **woody vegetation or weeds growing at the interior of building spaces should be removed**. Such **organic growths shall be cut out and treated with a suitable herbicide**. Regarding the latter, reference is made to the description given for the selection and use of herbicides in the technical specifications referring to the treatment of organic growths.
5. Dead plants and cut out foliage shall be collected and disposed regularly throughout the cleaning process.

All cleaning **works shall be carried out manually and/or using hand-held equipment**. The use of excavators at the interior of the Monastery is not permitted as this entails the danger of causing damage to the historic fabric, while the confined space at the access points of the building currently limits the use of such machinery.

2.2.2 [S2] CONTROL OF ORGANIC GROWTH

2.2.2.1 Scope and application

Control of organic growth includes:

- **cleaning of masonry surfaces from algal slimes, lichens and mosses,**

  Constituting surface depositions which may cause chemical alteration and soiling of masonry materials (including the stonework and the coatings plaster/render layers).

- **removal of plants growing within the masonry joints**,

  which induce mechanical damage due to the pressures exerted by the roots on the surrounding materials.

Measures for the control of organic growths shall be implemented to **all parts of the Monastic complex** indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study.

Therefore, prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.2.2 Materials

2.2.2.2.1 Biocide

For the removal and prevention of mould, algae, mosses and lichens a biocide containing carbamate fungicide or quaternary ammonium salts may be used. The biocide can be of the commercial type '***Wycamol Microtech Biocide*'** or ***'Kimistone BIOCIDA'***. The use of other **products with equivalent characteristics** is permitted. The selection of the biocide should respect the environmental regulations of the European Union for the use of herbicides in environmentally sensitive areas.

Prior to the initiation of works, the contractor must provide samples and specifications of the intended biocide compound **subject to approval by the supervising Architect and Civil Engineer**.

The instructions of the manufacturer should be followed in detail for the dilution and application of the selected biocide.

2.2.2.2.2 Herbicide

For the control of weeds a Glyphosate-based herbicide may be used. The herbicide can be of the commercial type **'*Monsanto Roundup Pro Biactive*'**. The use of **other products with equivalent characteristics** is permitted. The selection of the herbicıde should respect the environmental regulations of the European Union for the use of herbicides in environmentally sensitive areas.

Prior to the initiation of works, the contractor must provide samples and specifications of the intended herbicide compound **subject to approval by the supervising Architect and Civil Engineer**.

The instructions of the manufacturer should be followed in detail for the dilution and application of the selected herbicide.

2.2.2.2.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. Biocide and herbicides should be stored in accordance to the

specifications of the manufacturer. It is noted that such chemical compounds should generally be stored in the closed, original container in which they were supplied and should be kept in a dry, cool, well-ventilated area out of direct sunlight.

2.2.2.3 Methodology

2.2.2.3.1 Cleaning of surface organic growths

Surface growths, including algae, cyanobacteria, fungi, lichens and mosses should preferably be cleaned by:

Option (i): A **combination of abrasive methods and chemical treatment**.

- **Built up depositions of organic growths should initially be removed**. Such preparatory action can be carried out using wooden scrapers.
- The **face of the organic growths should be abraded using bristle brushes** in order to optimize the penetration and hence the effect of the biocide solution.
- The **diluted biocide can then be applied** with a low pressure pneumatic sprayer. The biocide should be applied as a flood coat, commencing at the top of the surface to be treated and moving across horizontally. Successive horizontal coat layers must overlap. Biocide treatment should take place when surfaces are reasonably dry and when rain in not imminent. It is also strongly recommended to carry out the application in wind free conditions to minimize spray drift.
- Once existing organic growth has been killed by initial application (typically within 3 to7 days) this should be **removed by brushing or power hosing**.
- Removal of the killed growth should be **followed by a second application of the biocide compound**.

Option (ii): Surface growths may be entirely removed by means of abrasive methods.

- Works should be carried out only in dry conditions.
- A **trial application on a surface approximately 1.5 m^2** must be carried out to ensure that these do not result to damage or discoloration/alteration of the historic fabric.
- Cleaning of surface growths can commence only after the trial application is considered successful and the contractor has identified and marked all positions where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.
- The surface growths shall be removed by lightly scraping or bristle brushing and then gently washing down the area. Wooden scrapers should be used in preference to metal ones in order to avoid scouring the substrate and, on **no account**, should wire brushes be used as these can damage the stonework and its coatings.
- The treatment/ cleaning of **plaster/render surfaces** shall be carried out **under the physical presence and supervision of a qualified Conservator** as specified in this document.

2.2.2.3.2 Removal of growing vegetation

(i) Removal of growing vegetation can commence only after the contractor has identified and marked all positions where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer

(ii) For the removal of higher plants, the method applied shall be based on the type, size and extent of the growth; i.e. weed, fern or shrub.

- Small plants, such as weed, can be simply cut out from the masonry.

- Plants of appreciable size (e.g. ferns or shrubs) growing within the mass of the masonry may also be **removed by mechanical means, given that this can ensure complete removal of the root systems** and associated soil/debris from joints, voids and facework. The use of dampened temporary timber wedges or other approved method to assist removal of roots is permitted.
- In case where plant growths cannot be removed completely without disturbing masonry, the procedure shall involve **cutting away of excess foliage followed by the application of herbicide** to kill the organic growth.
    - Initially, a length of the main stem of the plant should be cut out at a convenient height to facilitate the application of the herbicide. It is noted that the remaining length of the stem may depend on the specifications given by supplier of the herbicide compound.
    - The plant shall then be left to die and **after adequate time has passed its roots must be carefully cut or pulled from the masonry**. Following the removal of any higher plant, the **masonry substrate shall be repaired**. The repair method that will be adopted will depend on the extent of damage inflicted by the organic growth. The conditions stated below apply:
        - **Narrow cracks** (crack mouth opening ≤ 3 mm) not extending in depth within the masonry shall be filled with mortar applying the methodology hereby prescribed for the **repointing** of joints.
        - **Wide cracks** (crack mouth opening ≤ 15 mm) that may or may not extend in depth within the masonry shall be repaired my means of **grout injections** applying the corresponding methodology hereby described.
        - Areas exhibiting relatively **large fissures** (crack mouth opening > 15 mm) **and/or voids** extending into the core of the masonry shall be treated by **local reconstruction** of the affected section applying the corresponding methodology hereby described.

(iii) As soon as the growing vegetation is removed, the contractor must inform the supervising Architect and Civil Engineer regarding the condition of the masonry members affected by such works and must obtain consent for the method that be applied for their repair.

Particular note is hereby made on the **execution of works at the areas where historic plaster/render coatings exist**. In such cases, particular **measures for the protection of the coatings shall be implemented** based on instructions given by the supervising Architect and Civil Engineer.

The works on such areas shall be carried out **under the physical presence and supervision of a qualified Conservator** as specified in this document.

After the removal of vegetation growing within the masonry **appropriate monitoring shall be applied by the Contractor on the repaired area for a period of at least to 4 months** ensure that no further damage develops due to the shrinkage of drying plant sections that remain embedded in the masonry. In case such damage occurs it shall be the responsibility of the Contractor to perform appropriate repairs for its treatment.

2.2.3 [S3] REMOVAL OF PLASTER/ RENDER COATINGS

2.2.3.1 Scope and application

The specification hereby given refers:

(i) To the **removal existing cement-based coatings from masonry surfaces** which are considered to be practically impervious and tend to promote moisture-driven decay.

(ii) The **removal of render/plaster coatings which have lost adherence to the masonry substrate and their collapse is imminent.**

(iii) The **localized removal of coating material in order to facilitate the installation of injection tubes for the implementation of grout repairs and the execution of repointing works**.

The execution of such coating removal works must be done with outmost care to avoid causing damage of the masonry substrate and to rule out the loss of any historic plasters/renders or paintwork layers that may be hidden under the existing coating materials.

The areas of the Monastic complex where removal of cementitious coating materials should be carried out, as well as the areas where relevant works are required for the repair of cracks are indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study. Therefore, prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.3.2 Methodology

2.2.3.2.1 Preparatory actions

(i) A **detailed investigation by a qualified Conservator** as herein before specified and the **receipt of instructions by the supervising Architect and Civil Engineer based on the findings of this study** are prerequisites for the implementation of any works on plaster/render coatings.
(ii) Before the initiation of coating removal works **appropriate protection should be provided to the parts of the structure which are adjacent to the indented working positions**, so as to ensure that no damage to the historic fabric composing these parts is caused.

Particular emphasis shall be given on areas where only localized removal of coatings is required to facilitate crack grout injection repairs.

(iii) The Contractor must identify and mark on site all areas where coating materials shall be removed.

(iv)The marked areas shall be inspected by the supervising Architect and Civil Engineer, the consent of which will be required for the initiation of works.

2.2.3.2.2 Execution of works

(i) All works involving the **removal of existing coating materials shall be carried out in the presence of a qualified Conservator**.

(ii) Any **removal of plasters must be done after Conservator's approval and in the presence of the Conservator**. The Conservator will supervise the works and inspect the treated surfaces, aiming to rule out the possibility of damaging any underlying layers of historic plasters/renders or wall paintings which are not currently visible.

(iii) In case such artifacts are recorded, coating removal works shall be terminated and the intervention methodology hereby described will be revised to account for measures concerning safeguarding of the historic fabric.

(iv) During the execution of any works involving the removal of coatings the Conservator must submit to both the Client and the supervising Architect and Engineer a written report on a daily basis. This report must include:

- Detailed information on the areas treated and the methods applied
- Relevant and supportive photographic documentation.

(v) In order to avoid inducing damage to the masonry substrate, the **existing coating materials shall be manually removed using a hammer and chisel**. Small power or air chisels can be used to assist the removal of cementitious coatings, provided that in situ tests are carried out to ensure that the stonework substrate is not affected.

- For this purpose, a trial application on a surface of approximately 1-1.5 m^2 area should be initially carried out subject to approval by the supervising Architect and Civil Engineer. In order to avoid inducing damage to the masonry substrate it is recommended that mechanical pneumatic tools meet the following specifications: hand-held portable air chisels with controlled operating pressure ≤ 1 MPa; hand-held portable power chisels with operating power 300-500 W.
- The application of hydro-blasting/hydro-scarifying, sandblasting, wet abrasive blasting or any combination of these methods is **not** permitted.

(vi) In the course of coating removal works, moistening of surfaces and/or low pressure spraying of relatively small amounts of water can be applied to reduce the dust generated.

(vii) All working areas shall be regularly cleaned both during and after the implementation of coating removal works.

(viii) At the end of each working day, the coating materials removed shall be collected and moved to areas where they may be loaded and transferred away from the site. Coating materials removed shall not be reconstituted and reused for any of the construction works associated to this project.

(ix) Following the removal of the coatings, the **exposed masonry surfaces shall be cleaned thoroughly** by means of low-pressure hydro-cleaning combined with millet brushing and/or application of pressurized air.

2.2.4 [S4] REPAIR OF DAMAGED LINTELS

2.2.4.1 <u>Scope and application</u>

The intervention methodology involves:
(i) The **replacement of damaged timber or steel lintels** (i.e. lintels that exhibit deflections/cracks and/or have been affected rot, insect infestation or corrosion).
The aim will be to prevent further damage and potential failure of the overbearing masonry above the lintel.

(ii) **Restoration of masonry sections that have partially collapsed due to failure of lintels**.
The aim will be to reestablish the structural integrity of the load-bearing section.

The positions of the lintels that should be replaced are shown in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study. Therefore, prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.4.2 Materials

2.2.4.2.1 Timber sections

- All timber elements used shall be composed of **C18 class softwood** in accordance to the specifications set in EN 338.
- The cross-sectional dimensions of **members used for the replacement of existing building components shall be identical to those found on site**.
- In case the cross-sectional dimensions of the members to be replaced preclude the use of standardized wood products, the **use of other timber materials resembling those on site may be considered**.
- Only the **use of sorted timber** is permitted. The use of timber members with imperfections and/or defects (i.e. knots, shakes, twisted/torn fibers, splits, rind galls, burls, shrinkage deformations, chemical strains, druxiness, rot, sap, signs of insect infestation) is not acceptable.
- In any case, the **Contractor must provide experimental results or specification sheets for the selected materials** indicating that their mechanical properties are equivalent or superior to those of class C18 structural timber.
- All timber elements used shall be **pre-treated with a suitable wood preservative** to address potential damage by dry/wet rot and from wood destroying insects. Pressure treatments with Chromated copper arsenate (CCA) compounds and immersion treatments with creosote compounds are acceptable.
    - Existing timber members that will be retained in the structure shall be treated using a brushable, sprayable and/or injectable boron-based wood preservative compound.
    - The selected material must leave no surface residues after treatment, must be non-staining and should be capable of receiving additional treatment coatings or paint overlays in time.
    - The wood preservative can be of the commercial type ***'Wykamol Wykabor 20.1'*** or ***'ProBor 20'***. The use of **other commercially available products with equivalent characteristics** is permitted.
    - Prior to the initiation of works, the Contractor must provide samples and specifications of the intended wood preservative compound **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer of the compound should be followed in detail.
- Then, the timber elements shall **receive 3 coatings of protective paint suitable for outdoor use**. The paint can be of the commercial type ***'sylvanol lm'*** *or equivalent*.
    - The use of **other products with equivalent characteristics** is permitted, subject to approval by the supervising Architect and Civil Engineer.
    - Prior to the initiation of works, the Contractor must provide samples and specifications of the intended topcoat material **subject to approval by the supervising Architect and Civil**

Engineer. The application instructions of the manufacturer of the compound should be followed in detail.

2.2.4.2.2 Steel sections

- All steel members used shall be composed of **S275 grade hot rolled structural steel** in accordance to the specifications set in EN 10025-2.
- In case the sections of the existing members to be replaced are not within the range of the standardized sections produced nowadays, the selection of the closest matching section is permitted.
  - If there are no standardized sections similar in form and size to the existing ones, the fabrication of custom members can be considered.
  - In such a case the contactor must provide samples of the intended member subject to approval by the supervising Architect and Civil Engineer.
- **Any steel members used shall receive galvanization treatment** (i.e. protective zinc coating), to prevent rusting.

2.2.4.2.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

- Timber and steel members should be stored under a roofed (preferably enclosed) space.
- Timber should be stacked on pallets to maintain its flatness.
- There should be adequate room space for good air circulation around stacks.
- If timber is stored in enclosed space, this should be well ventilated.

2.2.4.3 Methodology

2.2.4.3.1 Preparatory actions

(i)Prior to the initiation of any works, the **Contractor must provide a method statement** clearly describing the intended course of action that will be implemented on site for the replacement of each of the lintels and for the support of the nearby structures.

(ii) Works may commence only after this method statement has been approved by the supervising Architect and Civil Engineer. Inspection and approval of any supports/props installed on site to facilitate the replacement of lintels is **a prerequisite** for the initiation of such works.

(iii) Works for the replacement of lintels should be carried out after **proper temporary supports** have been installed to make the working area safe. The installation of mechanical props on both sides of the wall to support the overbearing masonry above the lintel so as to avoid dismantling of the stonework for the replacement of the lintel is permitted, provided that the condition of the treated area and the available space do not preclude such measures.

2.2.4.3.2 Execution of works

(i) Site works concerning the replacement of damaged lintels can commence only after the Contractor has identified and marked all areas where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.

(ii) Props: if props are used for support the overbearing masonry above the lintel during its replacement, **slits extending along the entire thickness of the wall should be made and timber or steel supports should be inserted** (the use of steel plates > 25 mm thick is recommended).

- The supports must protrude from both faces of the wall to allow attachment to the top plates of the propping elements.
- The props shall be placed resting firmly to the ground, extended to the correct height and secure to the protruding sections of the propping elements using suitable fasteners.
- Afterwards, the **area along the entire length of the lintel must be cleaned**, progressively removing the existing mortar throughout the depth of the timber element, as well as any stone chips or sprawls attached to it.
- The e**xisting damaged lintel may then be removed and the new sections may be inserted into its place**.
- This should be followed by **filling of area around the new lintel with lime mortar and pieces of stone**. Reference is made to the specifications given regarding the repointing of masonry and the reconstruction of masonry sections for the implementation of the aforementioned works.
- After the jointing mortar applied hardens and develops adequate strength (typically > 7 days after application) the props and the **supportive masonry attachments inserted into the wall may be removed and the slits can be repaired using mortar and pieces of stone**.

(iii) **Manually dismantled and removed stonework above the lintel** if the use of props is not practically feasible.

- It is strongly recommended that prior to dismantling of the masonry and during the execution of this work detailed photographic record and/or other type of documentation is kept to guide the reconstruction process.
- All stone blocks which are in good condition should be stored so that they may be used in the reconstruction of the masonry after the replacement of the lintel.

(iv) When complete dismantling of all courses of overbearing masonry has been finished, the **damaged member can then be removed** and a **new lintel of the same cross-section can be installed**. Following the replacement of the lintel, the **overbearing masonry can be reconstructed** in accordance to the relevant technical specifications hereby given.

(v) In cases **where the new lintels are composed of more than one timber or steel members, these members shall be interconnected**.

- For timber lintels, packing pieces of appropriate size made of wood shall be installed using stainless steel fixings at distances no more than 30 cm along the entire length of the lintel.
- In the case of steel sections, factory-welded plates, or bolted connections may be used, subject to the approval of the supervising Civil Engineer.

2.2.5 [S5] TREATMENT OF TIMBER SECTIONS

2.2.5.1 Scope and application

The specification covers the in situ treatment of timber sections which are considered to be sound (i.e. do not exhibit fracturing and/or excessive deflections/cracks and/or have not been affected by rot/ insect infestation) and shall remain in the structure.
To the degree that this is practically feasible, such elements shall be treated without being removed from the structure.

- Timber elements recovered from partially collapsed areas shall be treated as hereby prescribed before being used for reconstruction purposes. All timber elements used shall be

pre-treated with a suitable wood preservative, to address potential damage by dry/wet rot and from wood destroying insects.

- Then, the timber elements shall **receive 4 coatings of clear mat varnish suitable for outdoor use**. The varnish can be of the commercial type ***'International Clear Wood Sealer Fast Dry'*** or ***'Sadolin Outdoor Varnish'*** or ***'Ronseal Yacht Varnish'***.
- The use of **other products with equivalent characteristics** is permitted, subject to approval by the supervising Architect and Civil Engineer.
- Prior to the initiation of works, the **Contractor must provide samples of the intended timber as treated and coated subject to approval by the supervising Architect and Civil Engineer**.

The areas where timber members that shall be treated in situ exist are shown in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study. Therefore, prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.5.2 Materials

2.2.5.2.1 Wood preservative

Existing timber members that will be retained in the structure shall be treated using a brushable, sprayable and/or injectable boron-based wood preservative compound.

The selected material must leave no surface residues after treatment, must be non-staining and should be capable of receiving additional treatment coatings or paint overlays in time.

The wood preservative can be of the commercial type ***'Wykamol Wykabor 20.1'*** or ***'ProBor 20'***. The use of **other commercially available products with equivalent characteristics** is permitted.

Prior to the initiation of works, the Contractor must provide samples and specifications of the intended wood preservative compound **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer of the compound should be followed in detail.

2.2.5.2.2 Wood topcoat

Treated timber members shall receive a topcoat of weather-resistant and UV-absorbent varnish suitable for exterior use. The varnish can be of the commercial type ***'International Clear Wood Sealer Fast Dry'*** or ***'Sadolin Outdoor Varnish'*** or ***'Ronseal Yacht Varnish'***.

The use of **other products with equivalent characteristics** is permitted.

Prior to the initiation of works, the Contractor must provide samples and specifications of the intended topcoat material **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer of the compound should be followed in detail.

2.2.5.2.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. Wood preservatives and varnishes should be stored in accordance to the specifications of the manufacturer. It is noted that such compounds should

generally be stored in the closed, original container in which they were supplied and should be kept in a dry and cool area protected from heat and frost.

2.2.5.3 Methodology

2.2.5.3.1 Preparatory actions

- In case the timber member to be treated exhibits grey appearance (i.e. discoloration) or de-natured texture, it is strongly recommended that this is thoroughly **sanded back to a clean sound surface**.
- Wood preservatives that shall be applied by means of brushing or spraying shall be applied to timber surfaces free from paint and varnish. **In case any of the members to be treated are coated which paint or varnish this shall be stripped off using a suitable method** with (i.e. application of paint/varnish-removal products and/or using scraper and/or by sanding), approved by the supervising Architect and Civil Engineer.
- In addition, the **surfaces that shall be treated must be thoroughly cleaned** to be free from dust, shavings and splinters.
- In cases the configuration of the building member precludes sufficient coverage of the timber member's surface with a brushable or sprayable compound or the existing paint/varnish coatings cannot be removed, an injectable treatment material should be applied. For this purpose, **holes shall be drilled into the timber to facilitate the injection of the preservative**.

2.2.5.3.2 Execution of works

(i) Prior to the initiation of any works conserving the treatment of timber, the Contractor must **identify and mark all timber members that are considered to be in sound condition** and are interned to be retained in the structure.
(ii) These shall be inspected by the supervising Architect and Civil Engineer, the consent of whom is required for proceeding with the preservation of the members.
(iii) The Contactor must carry out a **trial application of the selected wood preservative compound on 2 timber sections** adjacent to masonry materials to ensure that this does not cause any discoloration/alteration of the treated elements and of the surrounding the historic fabric (i.e. stonework and plaster/render coatings).
(iv) In situ treatment of timber can commence only after the trial application is considered successful and the contractor has identified and marked all positions where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.
(v) All timber surfaces that will be treated with **wood preservatives applied by means of brushing or spraying** shall receive 0.5 L of preservative compound per m^2, and in any case **at least 2 coating layers shall be applied**.
(vi) The preservative shall be applied in generous coats, taking care to ensure that end grains, corners and joints are well treated. For the particular case of brush application, to aid brushing out on any timbers which are very dry or remain dusty even after cleaning, a limited amount of water can be applied on the surface before the application of the compound.
(vii) When the preservative is applied by means of injection, the **compound shall be infused into the timber until refusal through the pre-drilled holes**.
(viii) After completion of the injection process the **holes drilled into the timber shall be completely sealed with a wood-filler material suitable for exterior use** and compatible with the selected varnish material. Any other minor surface defects or imperfections can also be sealed with the same filler.

(ix) After the completion of the treatment, the timber section shall receive **at least 4 coats of protective varnish**. The varnish shall be applied in a full flowing coat using a suitable bristle brush, ensuring all surfaces and end grains are fully coated.

- Between successive coats, a minimum of 16 hours shall be allowed to ensure sufficient drying of the varnish applied.

2.2.5.3.3 Protection and curing

Wood preservatives and varnishes shall not be applied during rainy days, if there is a risk of rain and during periods of excessively high relative humidity (> 80%). Treated surfaces must be protected from frost and rain until fully dry.

2.2.6 [S6] REPOINTING OF MASONRY JOINTS

2.2.6.1 Scope and application

Repointing involves the **refilling of the outer part of the masonry joints** in:

(i) Areas where the **existing mortar exhibits signs of degradation.**
(ii) Areas where **narrow cracks** (crack mouth opening ≤ 3 mm) not extending in depth within the masonry are noted after the removal of growing vegetation of sections of plaster/render coatings.
(iii) The base of the masonry walls in order to consolidate the area along the basal support of the load-bearing elements

The aims of this intervention are:
(i) to restore some degree of cohesive strength among the masonry units
(ii) to seal the masonry joints in order to prevent infiltration of water from surface runoffs and enhance durability.

Repointing will be applied to **all parts of the Monastic complex** where the existing mortar joints are crumbling, loose and or have weathered back to such an extent that the edges of the stone masonry units are exposed. The areas that should be repointed are indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study.

Prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.6.2 Materials

2.2.6.2.1 Repointing mortar

The material used for repointing the masonry should be a **general purpose lime-based mortar the color and texture of which are compatible with those of the mortars observed on the masonry structures of the monument**. The mortar can be of designed (i.e. with specified composition and manufacturing method) or prescribed (i.e. made in predetermined proportions of constituents) composition.

- If a designed mortar is used, its composition should be based on Natural Hydraulic Lime and the material must satisfy the specifications set in EN 998-2. The mortar can be of the commercial type ***'Mape-Antique Allettamento'*** or ***'BASF Albaria Alletamento'***. The use of **other products with equivalent characteristics** is permitted. Prior to the initiation of works, the contractor must provide samples of the intended designed mortar material **subject to**

approval by the supervising Architect and Civil Engineer. In case a designed mortar is used, the application instructions of the manufacturer should be followed in detail.

- If a prescribed mortar is used, this should be made from Natural Hydraulic Lime of grade NHL3.5 mixed with natural sand aggregates of grading 0-4 mm. The binder material can be of the commercial type ***'Limepor NHL3.5'*** or '***Lafarge NHL3.5***' and should satisfy the specifications set in EN 459-1. The use of **other products with equivalent characteristics** is permitted, subject to approval by the supervising Architect and Civil Engineer. The aggregates used for the composition of the mortar should be sharp sand, clean and well graded, free of clay, silt and organic matter. The use of local calcareous sand aggregate is recommended. The recommended proportions of the mortar **mixture are (lime: sand) 1:2 to 1:3 vol./vol**. In case a prescribed mortar is used, prior to the initiation of works, the **Contractor should prepare trial mixes and perform standardized laboratory tests** as per EN 1015-11 in order to prove that the minimum compressive strength of the proposed mix design is ≥ 2.5 MPa at 28 days.

2.2.6.2.2 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. Binder materials and/or pre-blended mortars delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost. Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.

2.2.6.3 Methodology

2.2.6.3.1 Preparatory actions

Repointing repairs shall commence only after appropriate preparation of the masonry substrate.
(i) Preparatory actions include **cutting out deteriorated mortar and removing crumbling/loose mortar sections** until a sound and compact working surface is obtained.

- Removal of existing mortar between joints shall be done manually using hammer and chisel, giving particular care to avoid inducing damage to the masonry units (i.e. stones).
- The use of mechanical equipment for cutting out mortar should be limited to hand-held power chisels (maximum 500W power). If such equipment is to be used, the contractor must perform tests on wall sections in order to prove that this does not affect the stonework.

(ii) **Existing mortar should be removed to a depth of approximately 2 to 2½ times the thickness of the joint**. In any case raking should **extend to a depth of at least 30 mm from the face of the masonry**.
(iii) The **masonry substrate should be cleaned thoroughly** to remove dust, fragments, mold or any other substance that may impair cohesion of the new mortar and to eliminate all traces of efflorescence and soluble salts.
For this purpose, low-pressure hydro-cleaning and/or cleaning with pressurized air can be applied.

- It is noted that in cases where removal of coatings (i.e. renders and/or plasters) should precede the implementation of repointing, the relevant procedure described in the corresponding technical specification should first be applied under the presence and supervision of a qualified Conservator as hereby specified.
- In areas where repointing will be conducted close to historic floors any other special elements of the Monastery, these surfaces must be covered using appropriate protective layers.

(iv) For the particular case of repointing the bases of the exterior walls across the perimeter of the Monastic complex, **excavation of the existing ground should be carried out**.

- To accommodate for the implementation of repointing interventions the topsoil along the base of the walls shall be excavated up to depth of approximately 60-100 cm below the existing ground level. The width of the excavation shall be adequate to enable the execution of repointing works. A width of ≥ 60 cm is generally recommended for this purpose.
- All excavation works must be carried out in the presence and under the supervision of a qualified Archeologist as hereby specified in this document.
- In case during the excavation works weak pockets of soil are noted near the masonry foundation, these shall be removed and replaced with a suitable granular fill. The granular fill shall consist of 0/32 aggregates of category G_A85 conforming to the requirements of EN 13242.

2.2.6.3.2 Execution of works

Mixing of mortars shall be carried out using a suitable mechanical mixer. The mixing time shall depend on the instructions given by the supplier of the binder material or of the designed mortar composition and shall be such that sufficient workability is attained without segregation (recommended mixing time 3-5 min). Mortar must be used before its workable life has expired. An indicative value of the maximum working life for lime mortars is 45 min. Any mortar left after the initial set has commenced should be discarded and should not be reconstituted. Mixing of mortar in excessively cold ($T < 4^oC$) or hot ($T > 38^oC$) weather conditions should be avoided as this can affected the workability and end-performance of the jointing material.

Prior to the initiation of repointing works, the Contractor must **prepare a sample area of 2 m²** approximate size that should be inspected and be subject to approval by the supervising Architect and Civil Engineer. Repointing can commence only after the sample has been accepted and the contractor has identified and marked all areas where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.

(i) Before applying the repair material, the **masonry substrate should be saturated with water** to prevent water mitigation from the fresh mortar that will compromise performance after hardening.

(ii) Any excess water after wetting of the substrate must be left to evaporate so that the masonry is saturated and the surface is dry. Compressed air may be used to speed up this process.

(iii) The repointing **mortar can then be applied manually with a trowel in one or more layers**, according to the depth and length of the joints to be filled. During the filling process, adequate pressure should be imposed on the filling material to ensure that this bonds well to the substrate. **Pointing should be recessed at about 0.5-1 cm from the face of the stones**. Protruding of the pointing mortar from the surface of the stonework shall not be accepted.

(iv) Any excess mortar must be removed immediately after application, including from masonry construction elements.

(v) **Gullets (i.e. chips or sprawls of stones) may be used along with the mortar for filling interstices among adjacent stones**, provided that such elements were present in the joint being repointed or that their use is justified by the construction pattern observed on adjacent areas of the wall. In all cases complete filling of the joints should be achieved by means of repointing.

(vi) Following the completion of the intervention, the **joints should be cleaned with a damp sponge or with a millet brush**.

(vii) Upon completion of the repointing works at the exterior perimeter of Monastic complex, the **excavated areas shall be covered with granular material so that drainage trenches which will reduce the amount of surface water infiltrating the masonry are formed**. Initially, the excavated area shall be filled with a layer of the removed soil up to a depth of 50 cm from the ground level. The soil placed back in the excavated trench shall be compacted manually using a hand-operated earth rammer. Upon the compacted soil, a geotextile fabric membrane suitable for the separation of layers with different particle size and distribution and for the filtration of vertical water drains shall be laid. The geotextile membrane shall extend along the entire base and side edge of the trench. During placement, the fabric should be stretched as tight and as flat as possible. Successive layers of the fabric should overlap by at least 30 cm. A granular material consisting of 0/32 aggregates of category G_A85 conforming to the requirements of EN 13242 shall be laid upon the geotextile fabric and shall spread evenly along the trench. The granular material shall be compacted using suitable mechanical equipment (the use of single direction plate compactor is recommended). The aggregate material shall be compacted to 100% of its maximum dry density as this is defined in BS 1377-9. The final thickness of the compacted granular drainage layer shall be 400-500 mm.

2.2.6.3.3 Protection and curing

Repointed masonry surfaces should be **protected from rain** falling directly onto the construction until the mortar has matured. Particular emphasis must be placed on protecting fresh mortar from being washed out of the joints.

Repointing **works should be stopped during periods of heavy rain** and the masonry sections should be protected.

Masonry surfaces should be protected from mechanical damage and disturbance taking into account other works in progress, subsequent construction operations and the use of scaffolding or of supporting installations at the areas near the repair.

For curing of the repointing mortar to complete effectively, **moisture shall be kept in the mixture for at least 72 hours** (or for a period equal to the curing period stated by the supplier of the mortar), before being allowed to dry out slowly. For this purpose water should be sprayed regularly on the joints.

2.2.7 [S7] RECONSTRUCTION OF STONE MASONRY SECTIONS

2.2.7.1 Scope and application

This type of intervention involves local **reconstruction of masonry sections using "patching" or "cladding" techniques**. The objective is to reinstate the geometry and recover the structural integrity of **areas that:**

(i) Have **suffered partial collapse.**

(ii) Incorporate masonry materials which **exhibit extensive and severe decay.**

(iii) Have suffered **cracking which extends to the core or the entire thickness of the wall and has crack mouth opening > 15 mm** which preclude efficient repair by means of grouting.

(iv) Have **missing elements/sections which need to be restored** in order to facilitate the installation of new building components (i.e. replacement of damaged lintels).

The positions where reconstruction is required are indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study.

Prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the positions indicated and to identify whether additional works may be required in other areas.

2.2.7.2 Materials

2.2.7.2.1 Stones for rubble masonry sections

The **color, shape, size and form of replacement stones should be representative of those observed** on the rubble masonry structures of the monument.

For the reconstruction of sections composed of rubble stone masonry, **natural building stones of local origin** (i.e. quarried in Cyprus) which satisfy the following specifications should be used:

- Apparent density as per EN 1936 ≥ 2500 kg/m^3
- Total open porosity as per EN 1936 ≤ 6%
- Capillary absorption coefficient as per EN 1925 ≤ 10 g/$m^2s^{1/2}$
- Compressive strength as per EN 1926 ≥ 40 MPa
- Color: Light-grey to grey (according to Munsel Soil Color System)

Alternatively and/or complementary to the above specifications compatibility of the replacement stones with the existing material can be decided based on the lithology, texture and mineralogy of the material. In this case the replacement stones should satisfy the following specifications:

- Lithology: Recrystallized brecciated limestones
- Mineralogy: Rich in calcite (≥ 80%) with significant amounts (> 5%) of dolomite

It is envisaged that **clastic sedimentary rocks belonging to the Kyrenia Terrane** may have properties which satisfy the criteria stated above.

In any case, compatibility between the replacement material and the historic fabric should be proven on the basis of established testing methods and/or databases which provide adequate information concerning the characteristics of the materials.

Prior to the initiation of works, the Contractor must **provide samples and data on the properties of the intended stone material subject to approval by the supervising Architect and Civil Engineer**.

The use of field stones recovered within the boundaries of the monument and/or the reuse of stones recovered from sections subjected to reconstruction is permitted provided that these:

- Resemble the texture, from and size of the stone fabric at the area under reconstruction
- Do not exhibit damage which may affect their performance in use (i.e. cracks, fissures, exfoliations, surface deterioration).

2.2.7.2.2 Stones for ashlar masonry sections

The **color, shape, size and form of replacement stones should be representative of those observed** on the ashlar masonry structures of the monument.

For the reconstruction of sections composed of ashlar stone masonry, **natural building stones of local origin** (i.e. quarried in Cyprus) which satisfy the following specifications should be used:

- Apparent density as per EN 1936 ≥ 1600 kg/m^3
- Total open porosity as per EN 1936 ≤ 40%
- Capillary absorption coefficient as per EN 1925 ≤ 350 g/$m^2s^{1/2}$

- Compressive strength as per EN 1926 ≥ 3 MPa
- Color: Light brownish-orange-yellow (according to Munsel Soil Color System)

Alternatively and/or complementary to the above specifications compatibility of the replacement stones with the existing material can be decided based on the lithology, texture and mineralogy of the material. In this case the replacement stones should satisfy the following specifications:

- Lithology: Calcareous clastic sedimentary rock
- Mineralogy: Rich in calcite (≥ 80%) and containing (> 5%) of silicates (quartz and/or plagioclases)

It is envisaged that **calcarenites belonging to the Nicosia–Athalassa geological formation** may have properties which satisfy the criteria stated above.

In any case, compatibility between the replacement material and the historic fabric should be proven on the basis of established testing methods and/or databases which provide adequate information concerning the characteristics of the materials. Prior to the initiation of works, the contractor must **provide samples and data on the properties of the intended stone material subject to approval by the supervising Architect and Civil Engineer**.

The use of field stones recovered within the boundaries of the monument and/or the reuse of stone recovered from sections subjected to reconstruction is permitted provided that these:

- Resemble the texture, from and size of the stone fabric at the area under reconstruction
- Do not exhibit damage which may affect their performance in use (i.e. cracks, fissures, exfoliations, surface deterioration). Jointing mortars
-

2.2.7.2.3 Jointing mortar

The jointing material used for the laying of the masonry units should be a general purpose lime-based mortar the color and texture of which are compatible with those of the mortars observed on the masonry structures of the monument. The mortar can be of designed (i.e. with specified composition and manufacturing method) or prescribed (i.e. made in predetermined proportions of constituents) composition.

If a designed mortar is used, its composition should be based on Natural Hydraulic Lime and the material must satisfy the specifications set in EN 998-2. The mortar can be of the commercial type **'*Mape-Antique Allettamento*'** or ***'BASF Albaria Alletamento'***. The use of **other products with equivalent characteristics** is permitted.

Prior to the initiation of works, the contractor must provide samples of the intended designed mortar material **subject to approval by the supervising Architect and Civil Engineer**. In case a designed mortar is used, the application instructions of the manufacturer should be followed in detail.

If a prescribed mortar is used, this should be made from Natural Hydraulic Lime of grade NHL3.5 mixed with natural sand aggregates of grading 0-4 mm. The binder material can be of the commercial type or **'*Limepor NHL3.5*'** or '***Lafarge NHL3.5'*** and should satisfy the specifications set in EN 459-1. The use of **other products with equivalent characteristics** is permitted, subject to the approval of the supervising Architect and Civil Engineer.

The aggregates used for the composition of the mortar should be sharp sand, clean and well graded, free of clay, silt and organic matter. The use of local calcareous sand aggregate is recommended. The **recommended proportions of the mortar mixture are (lime: sand) 1:2 to 1:3 vol./vol**. In case a

prescribed mortar is used, prior to the initiation of works, the **Contractor should prepare trial mixes and perform standardized laboratory tests** as per EN 1015-11 in order to prove that the minimum compressive strength of the proposed mix design is ≥ 2.5 MPa at 28 days.

2.2.7.2.4 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. Building stones should be kept in a dry clean space and should be protected from mechanical actions (e.g. impact, abrasion etc.), as well as from dirt and frost. Ashlar and/or specially carved stones should be placed on timber supports and/or palettes. Other materials delivered in bulk (e.g. sand) should be kept on firm floor/ground to facilitate the transport and use. Any materials delivered packed in sacks (e.g. binder materials and/or pre-blended mortars) should be stored separately on palettes and should be protected from moisture and frost.

2.2.7.3 Methodology

2.2.7.3.1 Preparatory actions

Masonry reconstruction works should be conducted following the **installation of suitable temporary supports** that will ensure stability and safety of the area under repair**.**

(i) Deteriorated, cracked, particularly loose and/or poorly bonded material should be removed from the treated section, leaving rough edges to offer better grip between the new and existing masonry.

(ii) In the process of material removal, stone blocks which are in good condition may be stored in order to be reused for the reconstruction of the masonry.

(iii) Before laying of new masonry courses initiates, all support and **jointing surfaces should be cleane**d to enhance adhesion of the new mortar to the substrate. For this purpose, low-pressure hydro-cleaning and/or cleaning with pressurized air can be applied.

(iv) Horizontal and vertical strings should be installed as guides to mark the layout of the section to be constructed. In areas where reconstruction works will be conducted close to historic floors any other special elements of the Monastery, these surfaces must be covered using appropriate protective layers.

2.2.7.3.2 Execution of works

The **construction typology of the reconstructed part shall resemble that of the section being treated**.

Prior to the initiation of reconstruction repair works, the **Contractor must prepare masonry samples of about 2 m^2** approximate size that should be inspected and be subject to approval by the supervising Architect and Civil Engineer.

Reconstruction repairs can commence only after the samples have been accepted and the contractor has identified and marked all positions where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.

Random rubble masonry shall be uncoursed, while **ashlar** masonry shall be coursed and composed of dressed stones.

(i) Random rubble masonry:

- **Stone blocks used for the construction of rubble masonry sections should be cleaned from dirt/dust and must be pre-wetted** at the time of placement to mitigate water adsorption from the mortar and thus ensure adequate setting of the jointing material.
- Hummer-dressing of the face, sides and beds of stones to achieve adequate resemblance between existing fabric and replacement material is permitted. No dressing or hammering which may potentially loosen the stone units is permitted after these are set in place.
- Stones used to replace ashlar blocks in particular (including those intended to be used in arched sections), shall be cut to the required size and shape and their surface roughness shall be such that it can give truly vertical, horizontal and/or radial joints.
- In order to facilitate ease of construction, it is recommended that the length of any stones used for the reconstruction of rubble masonry does not exceed 3 times their height or breadth, nor be greater than ¾ the thickness of the wall, while their height may be up to 30 cm.
- Mixing of mortars shall be carried out using a suitable mechanical mixer. The mixing time shall depend on the instructions given by the supplier of the binder material or of the designed mortar composition and shall be such that sufficient workability is attained without segregation (recommended mixing time 3-5 min).
- Mortar must be used before its workable life has expired. An indicative value of the maximum working life for lime mortars is 45 min. Any mortar left after the initial set has commenced should be discarded and should not be reconstituted.
- Mixing of mortar in excessively cold ($T < 4^oC$) or hot ($T > 38^oC$) weather conditions should be avoided as this can affected the workability and end-performance of the jointing material.
- Rubble masonry sections can be “patched” or “cladded” by **creating an “installation bed” of mortar and then laying the stone blocks** (either the original ones previously removed or new ones) on the mortar.
- Stones shall be set and laid into position by a rubber or wooden mallet and shall be firmly bedded in mortar. Replacement stones should be pressed down using adequate force to ensure that sufficient grip is achieved with the existing masonry units.
- Particular emphasis shall be placed at angular junctions, where the stones must be well bonded into the respective courses of the adjacent wall(s).
- Each stone shall be placed close to the stones already in place so that the **thickness of the mortar joints does not exceed 25 mm**. Face stones shall be arranged suitably to **stagger the vertical joints** and long vertical joints shall be avoided. The latter also applies for the treatment of cracked sections, where the **stone blocks must be placed in a way that “stitching” of the crack is achieved**; i.e. the stone blocks installed bridge the cracks.
- Gullets (i.e. chips or spalls of stones) shall be used for filling of interstices between the adjacent stones. **Chips and spalls of stones shall be used wherever necessary to avoid thick mortar beds or joints** and it shall also be ensured that no hollow spaces are left anywhere in the masonry.
- Selected long stones (i.e. plum stones) shall be embedded vertically in the core of the reconstructed masonry section to form a bond between successive courses. In case of complete reconstruction of the masonry section, the two **leaves of the stonework shall be constructed simultaneously**.
- **Through stones** running along the entire thickness of the masonry and bonding the two leaves of the stonework shall be provided in sections up to 600 mm thick.

- Alternatively, and in cases where the thickness of the masonry is > 600 mm, a set of two or more **bond stones overlapping each other** by at least 150 mm shall be provided in a line from face to back. At least one through stone or set of bond stones shall be provided every approximately 0.6 m^2 of wall surface. It is noted that the presence of through or bond stones has not been noted in the construction pattern of the monument's rubble masonry walls. Nevertheless, the addition of such elements is strongly recommended in order to ensure structural stability of the reconstructed parts.
- During construction, any excess mortar shall be removed with a trowel.
- The **maximum allowable height of masonry that may be constructed per day on each wall section is 80 cm**. When this height is reached, construction should be interrupted in order to allow sufficient time for the setting of the mortar and resume after approximately 1 day.
- The rubble stonework shall be in perfect plumb. For this purpose, dimensions and planeness should be regularly checked as the work proceeds.
- Splashes of mortar or other stains on the stone materials should be cleaned off as soon as practicable after they occur by brushing. In any case, after completion of the reconstruction work and sufficient setting of jointing mortars, **the face of the wall shall be thoroughly cleaned with a brush**. **If required, pointing may be applied** using the same mortar as that laid among the stones, so as to ensure that all joints are properly filled.

(ii) Ashlar masonry:

- In the case of ashlar masonry, stone blocks shall be laid in regular courses following a running bond pattern identical to that observed on the area to be treated.
- The general principles set for the repair of rubble masonry also apply to ashlar masonry, with the exceptions hereafter described.
- The **bonding arrangement of ashlar blocks shall copy the existing construction pattern, unless the positioning of the original vertical joints does not allow for adequate overlapping among the stones**.
- In the latter case, a **minimum overlapping length of 100 mm** should be ensured between alternating courses of masonry units. Stones shall then be fixed with mortar in position without the use of chips or underpinning of any sort. All joints shall be full of mortar. The face of the **joints among ashlar units shall be uniform throughout**, and their **thickness shall be kept as small as possible, not exceeding 5 mm**.
- Again, repair of two-leaf walls shall involve simultaneous construction of the two parallel stonework faces without exceeding a construction height of 80 cm per day.
- Unless the thickness of the ashlar blocks is equal to that of the masonry section to be repaired, through or bond stones shall be provided, as described for the case of rubble masonry.
- Ashlar masonry sections shall be carried up truly plumb.
- Where reconstruction is conducted on arched and/or circular moulded masonry sections, appropriate centering and shuttering should be installed to ensure that the form and radial pattern of the reconstructed section truly copies that of the original member.

2.2.7.3.3 Protection and curing

Completed masonry should be **protected from rain** falling directly onto the construction until the mortar has matured. Particular emphasis must be placed on protecting fresh mortar from being washed out of the joints.

Reconstruction **works should be stopped during periods of heavy rain** and the masonry sections should be protected.

Masonry surfaces should be protected from mechanical damage and disturbance taking into account other works in progress, subsequent construction operations and the use of scaffolding or of supporting installations at the areas near the repair.

For curing of the jointing material to complete effectively, **moisture shall be kept in the mortar mix for at least 72 hours** (or for a period equal to the curing period stated by the supplier of the mortar), before being allowed to dry out slowly. For this purpose water should be sprayed regularly on the surface of the masonry.

In cases where formworks and/or other supportive elements have been used, these should be removed one week after completion of the construction.

The application of loads on newly constructed walls is **not** permitted.

Any loads can be imposed on reconstructed sections only when at least one week has passed after completion of the construction.

2.2.8 [S8] CONSTRUCTION OF CAPPING LAYER

2.2.8.1 Scope and application

This intervention concerns the **construction of a capping/flaunching layer of mortar along the upper sections of the masonry with the purpose of preventing water seepage at the top of walls** that will not be protected by roofing.

The capping layer shall be composed of an eminently hydraulic lime mortar as hereby specified which is sufficiently resistant to rainwater exposure and is more compatible with the monument's masonry materials, compared to cementitious mortar.

The areas of the monastic complex where capping shall be applied are indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study.

Prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.8.2 Materials

2.2.8.2.1 Capping mortar

The material used for the construction of the capping layer should be a **general purpose mortar for external render based on Natural Hydraulic Lime**.

The color and texture of the mortars must be compatible with those of the mortars observed on the masonry structures of the monument.

The material should satisfy the requirements set in EN 998-1 for rendering and plastering mortars of Categories CS IV and W2 (i.e. compressive strength at 28 days ≥ 6 MPa and capillary water

absorption ≤ 0.2 kg/m^{2}min$^{1/2}$). The mortar can be of the commercial type **'*Mape-Antique Strutturale NHL*'**.

The use of **other commercially available products with equivalent characteristics** is permitted. If a commercially available product is to be used, prior to the initiation of works, the contractor must provide samples and specifications of the intended mortar material **subject to approval by the supervising Architect and Civil Engineer**. In case a commercial mortar is selected, the application instructions of the manufacturer should be followed in detail.

The **use of purposely designed mortar mixtures is also permitted**. Such mixtures should be made from Natural Hydraulic Lime of grade NHL5 mixed with natural sand aggregates of grading 0-4 mm. The binder material can be of the commercial types **'*Saint-Astier NHL5*'** or **'*SECIL NHL5*'** and should satisfy the specifications set in EN 459-1.

The use of **other products with equivalent characteristics** is permitted. The aggregates used for the composition of the mortar should be sharp sand, clean and well graded, free of clay, silt and organic matter. The use of local calcareous sand aggregate is recommended.

The **recommended proportions of the mortar mixture are (lime: sand) 1:2 to 1:2½ vol./vol**. In case a purposely designed mortar mixture is used, prior to the initiation of works, the **Contractor should prepare trial mixes and perform standardized laboratory tests** as per EN 1015-11 and EN 1015-18 in order to prove that the proposed material has a compressive strength at 28 days ≥ 6 MPa and a capillary water absorption coefficient of ≤ 0.2 kg/m^{2}min$^{1/2}$.

2.2.8.2.2 Mesh reinforcement for capping layer

To prevent the formation of cracks and to enhance stability, the render capping layer shall be reinforced with an alkali-resistant glass fiber mesh system suitable for the strengthening of structural render. The mesh system selected must be complemented by non-metallic connectors/fasteners. The mesh can be of the commercial type **'*Mapegrid G120*'** or **'*Mapenet G220*'** or **'*ADFORS Vertex G96*'** or **'*ADFORS Vertex G120*'**.

The use of other commercially available **products with equivalent characteristics** is permitted. In case a material other than those specified here will be used, the contractor must provide samples and specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.8.2.3 Finish coating

The capping material shall be coated with a transparent and transpirant water-repellent material that will enhance its resistance to deterioration due to eroding action of rainwater. The finish coating shall meet the requirements set in EN 1062-1 for materials of class W_3 with low liquid water permeability (i.e. ≤ 0.1 kg/m^{2}min$^{1/2}$). The coating can be a siloxane resin impregnator of the commercial type **'*Antipluviol S*'** or **'*Antipluviol W*'**.

The use of **other commercially available products with equivalent characteristics** is permitted **subject to approval by the supervising Architect and Civil Engineer**.

2.2.8.2.4 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

- Binder materials and/or pre-blended mortars delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost.
- Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.
- Water-repellent coating compounds shall be kept in dry, covered environment in their original packaging.
- Glass fiber meshes should be stored in a clean and dry place without being exposed to UV radiation.

2.2.8.3 Methodology

2.2.8.3.1 Preparatory actions

(i) Preparatory works for the application of the capping material should initiate with **manual removal of any elements at the upper sections of the walls which are deteriorated, cracked, flaky, particularly loose and/or poorly bonded**.

(ii) The **surfaces that will receive capping shall be cleaned thoroughly** to remove dust, mold, efflorescence/salts and any other material that may impair adhesion of the rendering mortar.

- For this purpose, low pressure hydro-cleaning and/or cleaning with pressurized air can be applied.

(iii) Measures for the control of organic growths may also need to be implemented in accordance to the relevant specifications.

(iv) Voids and uneven areas in the masonry must be repaired by patching or tacking with the same mortar as that used for the construction of the capping or that specified for repointing works, using also pieces of stone with similar characteristics to the original material.

(v) **Repointing and/or patching of masonry areas** shall be applied following the corresponding technical specifications hereby given (see **paragraph 2.2.6**). Such works shall aim at closing any cracks, fissures or voids and must result to the creation of a sound and compact working surface.

(vi) In areas where the upper section of the masonry exhibits large voids (i.e. ≥ 10 cm in height) and/or fracturing which cannot be treated by means of patching with mortar, **reconstruction repairs shall be carried out to create an even and compact working surface** that will receive the capping layer. Reference is hereby made to the relevant specification given in **paragraph 2.2.7** for the execution of such works.

(vii) After consolidation of the working surface, **the fasteners/connectors that will hold the reinforcement mesh shall be set in place**. These can be installed in holes drilled along the length of the masonry using a cement-free material specified by the supplier or manufacturer of the mesh system and approved by the supervising Civil Engineer.

- In areas where capping construction will take place close to historic floors or any other special elements of the Monastery, these surfaces must be covered using appropriate protective layers.

2.2.8.3.2 Execution of works

Mixing of the capping mortar shall be carried out using a suitable mechanical mixer. The mixing time shall depend on the instructions given by the supplier of the binder material or of the designed mortar composition and shall be such that sufficient workability is attained without segregation

(recommended mixing time 3-5 min). Mortar must be used before its workable life has expired. An indicative value of the maximum working life for lime mortars is 45 min. Any mortar left after the initial set has commenced should be discarded and should not be reconstituted. Mixing of mortar in excessively cold (T < 4°C) or hot (T > 38°C) weather conditions should be avoided as this can affected the workability and end-performance of the capping material.

(i) Prior to the initiation of capping construction works, the **Contractor must prepare a sample of approximately 2 m length** size that should be inspected and be subject to approval by the supervising Architect and Civil Engineer. Capping construction works can commence only after the sample is approved and the contractor has identified and marked all positions where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.

(ii) Before applying the capping mortar, the **masonry substrate must be partially saturated** to avoid adsorption of water from the mortar which will compromise the final performance characteristics of the capping layer.

- Any excess water after wetting of the substrate must be eliminated so that the masonry is saturated and the surface is dry.
- Compressed air may be used to speed up this process.

(iii) After saturation is achieved, **an initial 5 mm thick scratch-coat of mortar should be applied throughout the length of the working surface**, to even out the absorbency of the substrate and to improve adhesion of the capping layer.

(iv) After setting of the scratch-coat layer starts, subsequent layers of hydraulic lime mortar up to 30 mm thick should be applied using a trowel, so as to achieve a capping layer that covers the entire length of the walls' upper part. Any excess mortar spilled on the underlying historic fabric must be removed immediately after application.

(v) The positioning of the mesh should be such that this reinforcement layer would lie approximately at the mid-thickness of the finished render coating.

- Hence, **after applying the mid render layer, and while the mortar is still fresh, the mesh shall be placed all over the surface** and pressed down lightly with a flat trowel so that it adheres to the mortar and is positioned correctly against the fasteners/connectors applied previously. Adjacent pieces of mesh fabric should overall by least 40 cm, lengthways.

(vi) The **finished capping layer must be twice weathered** (i.e. shall create a double pitch) and should have an **average thickens of at least 50 mm at its lower part and at least 110 mm at its crest**.

- In addition, the capping layer shall not be flash with the vertical surfaces of the walls, but **must project by at least 25 mm from both faces of the walls** to provide better protection against the shed of vertical runoffs.
- The finishing of the mortar shall be as smooth as practically possible to maximize water shedding. The use of shims or other fixings on the walls to guide the application of the mortar and the creation of the desired form of capping is permitted, as long as this is practically feasible.
- The two protruding sections of the **capping layer must incorporate drip channels** along their entire length. These may be formed by scratching the mortar material when this is still flesh or by carving the hardened mortar material with a suitable tool.

(vii) Before application of the finish coating, any dirt, dust, salt laitance, or other agents that might prevent penetration of the water-repellent to the mortar substrate must be removed. For this purpose, the surfaces shall be scrubbed carefully with a scrubbing brush and any dust shall be removed with compressed air.

- Furthermore, existing stonework and plasters/renders near the area where the coating material shall be applied must be protected to avoid spillage of the compound on the historic fabric.
- Application can be carried out by means of manual shoulder mounted sprayers, rollers or brushes.

(viii) Prior to the use of the selected finish coating compound, a trial application on a capping surface approximately 1 m long must be carried out to ensure that the material does not result to discoloration/alteration of the treated substrate. The trial application is subject to approval by the supervising Architect and Civil Engineer.

(ix) When the capping mortar is completely cured (it is noted indicatively that complete curing of natural hydraulic limes on site requires approximately 7 days per cm of thickness), the **water-repellent finish coating shall be applied**.

- The finish coating shall be applied evenly on a dry and clean surface.
- The material shall be applied in a number of coats (as indicated by the manufacturer of the product used, but in any case ≥ 2) until the treated surface is completely saturated. Each successive coat shall be applied while the previous one is still wet.

2.2.8.3.3 Protection and curing

The capping layer should be **protected from rain** falling directly onto the construction until the mortar has matured.

Capping **construction should be stopped during periods of heavy rain** and the layers constructed should be protected.

The capping layer should be **protected from mechanical damage and disturbance** taking into account other works in progress, subsequent construction operations and the use of scaffolding or of supporting installations at the areas near the repair.

For curing of the capping mortar to complete effectively, **moisture shall be kept in the mixture for at least 72 hours** (or for a period equal to the curing period stated by the supplier of the mortar), before being allowed to dry out slowly. For this purpose water should be sprayed regularly on the joints.

The **application of the finishing coat shall not take place in wet weather**, when there is a likelihood of impending rain and when the atmosphere humidity level is excessively high (≥ 85%).

2.2.9 [S9] TREATMENT OF REINFORCED CONCRETE SECTIONS

2.2.9.1 Scope and application

The works hereby specified refer to the **treatment of concrete sections which have been affected by reinforcement corrosion**. Such members include:

(i) **Concrete lintels** (Block A).
(ii) **Concrete slabs** (Block C).
(iii) A **concrete frame structure** forming a belfry element (chapel of Block F).
(iv) A **concrete structure** forming a Baptistery (chapel of Block E).

The aims of this intervention are to provide an active coating to the reinforcement that will act as a corrosion inhibitor and to restore the concrete cover of the section. Reference shall be made to EN 1504-10 for site application of the products and systems hereby specified. The areas where concrete elements to be treated exist are indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study.

Prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.9.2 Materials

2.2.9.2.1 Active coating for reinforcement treatment

The material used for the treatment of reinforcement shall be a cement-based active coating containing electrochemically active pigments which may function as inhibitors or which may provide localized cathodic protection.

The material must meet the corresponding requirements set in EN 1504-7. The reinforcement treatment material can be of the commercial type ***'Mapefer'*** or ***'Mapefer 1K'*** or ***'Sika MonoTop-610'*** or ***'Sika MonoTop-612'*** or ***'SikaTop Armatec-110 EpoCem'*** or ***'Sika MonoTop-910N'*** or ***'Kimia Betonfix KIMIFER SP'***.

The use of **other products with equivalent characteristics** is permitted.

Prior to the initiation of works, the contractor must provide samples and specifications of the intended repair mortar material **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer should be followed in detail.

2.2.9.2.2 Structural repair mortar

The material used for the restoration of the concrete cover shall be a pre-batched shrinkage-compensated cementitious mortar meeting the requirements set in EN 1504-3 for structural repair mortars of class R3 or R4.

The material should be suitable for hand-placed application (i.e. using a trowel) or by mechanical application using wet spray equipment.

The mortar can be of the commercial type ***'Mapegrout Thixotropic'*** or ***'Mapegrout T60'*** or ***'Sika MonoTop-612'*** or ***'Sika Rapid Repair Mortar'*** or ***'Sika MonoTop-615'*** or ***'Kimia Betonfix RCA'*** or ***'Kimia Betonfix FB'***.

The use of **other products with equivalent characteristics** is permitted.

Prior to the initiation of works, the contractor must provide samples and specifications of the intended repair mortar material **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer should be followed in detail.

2.2.9.2.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

Repair mortars and reinforcement coatings should be stored in accordance to the specifications of the manufacturer.

Pre-blended mortars delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost.

Corrosion inhibitor compounds for the treatment of reinforcement must be stored in unopened containers in in a dry, sheltered place protected from humidity

2.2.9.3 Methodology

2.2.9.3.1 Preparatory actions

(i) The Contractor must initially identify and mark all concrete areas which shall be treated.

(ii) Proper temporary supports shall be installed on all areas to be treated to make the working area safe.

(iii) Substrate preparation shall include **removal of all deteriorated concrete to a depth of at least 15 mm behind the longitudinal reinforcement bars.** Removal of concrete must ensure that a solid, sufficiently-rough substrate with no detached or loose portions is obtained. Concrete removal can be carried out using:

- High pressure (~1100 bar) water jet (i.e. sandblasting or hydro-scarifying).
- A hammer drill.
- A hand or power chisel.

If the high pressure water jet method is selected, the Contractor must install appropriate protection to prevent damage of the surrounding historic fabric. In this case the Contractor must inform in advance the supervising Civil Engineer and Architect on the intended protective measures and must obtain their consent before proceeding with the concrete removal works.

Only deteriorated and defective concrete shall be removed and particular care shall be taken to avoid inducing any damage to the reinforcement.

Once prepared, the concrete surface to be repaired must have an uneven texture with at least 5 mm peak roughness. It is noted that if the prescribed surface roughness is not achieved, the supervising Civil Engineer can instruct the application of a suitable bonding primer for ensuring adequate adhesion between the concrete and the repair material.

(iv) Following the removal of deteriorated concrete, **all exposed reinforcement shall be thoroughly cleaned** from rust, from residues of concrete/mortar and from any loose materials, while tie wires must be removed. Cleaning shall ensure that reinforcement is brought back to a bare metal finish.

This can be achieved manually using a steel wire brush or using mechanical abrasive blast techniques (i.e. hydro-sandblasting).

Appropriate repairs must be conducted when reinforcement is damaged in the course of works and/or when the removal of concrete reveals the presence of reinforcement sections which suffer from fracturing or extensive loss of cross-sectional area. In such cases the supervising Civil Engineer shall be informed and the **steel reinforcement which has been cut, or which is damaged or highly corroded, shall be supplemented by new reinforcement** of the same cross-section. In such cases the damaged reinforcing bar must be cleaned and extra space shall be created by removing concrete to allow placement of the supplemental bar beside the old bar. The length of the supplemental bar must be equal to the length of the deteriorated segment of the existing bar plus a lap-splice length of at least 200 mm. Any new reinforcement bars used shall be of grade B500C as defined in EN 10080.

(v) The **Contractor must keep detailed photographic record** of the concrete substrate preparation process to facilitate inspection of works.

2.2.9.3.2 Execution of works

Mixing of reinforcement coating compounds and repair mortars shall be carried out using a suitable mechanical mixer. The mixing apparatus used and the mixing rate and time applied shall depend on the instructions given by the supplier or manufacturer of the selected materials and shall be such that homogenous mixtures are achieved. Reinforcement coating compounds and mortars must be used before their workable life has expired. An indicative value of the maximum working life for such materials is 60 min. Any mortar material left after the initial set has commenced should be discarded and should not be reconstituted. Mixing of reinforcement coating compounds and repair mortars in excessively cold ($T < 5^oC$) or hot ($T > 35^oC$) weather conditions should be avoided as this can affect the workability and end-performance of the materials.

(i) Application of reinforcement treatment compounds should be carried out immediately after cleaning of the reinforcement. All **exposed reinforcement bars shall receive a minimum of 2 coats of the selected corrosion-inhibitor compound**. Each layer of coating applied must be at least 1 mm thick and the final thickness of the coating must be greater than 2 mm. Reinforcement treatment can be applied by the following methods:

- **Application by brush**: The material can be applied by brush ensuring that the surfaces of the rods are completely covered in homogeneous coats. The simultaneous use of two brushes is strongly recommended to ensure full application behind bars.
- **Application by spraying equipment**: This method can be applied provided that it is prescribed in the specifications given by the manufacturer of the selected material. The apparatus used for the application of the compound shall meet the specifications given by the manufacturer of the material. It is indicatively noted that for the application of cement-based active coatings, many manufacturers specify the use of hopper spray guns. If a spray method is used, the substrate shall be protected from excessive over-spray and any concentrated accumulation of the compound applied must be wiped away. During the spraying process, the spraying apparatus must be pointed at different angles on the surface to ensure even application behind the bars.

(ii) Subsequent coats of corrosion-inhibitor compounds shall be applied after adequate time from the application of the previous coat has passed (typically > 12 hours).

(iii) Following the treatment of the reinforcement, the concrete cover shall be restored using the selected repair mortar. Prior to application of the repair material, the **masonry substrate should be saturated with water** to prevent water mitigation from the fresh mortar that will compromise performance after hardening. Any excess water after wetting of the substrate must be left to evaporate so that the masonry is saturated and the surface is dry. Compressed air may be used to speed up this process.

The repair mortar can be applied by the following methods:

- **Application by hand**: The repair mortar can be applied by hand using a flat or gauging trowel and/or a spatula. In this case, a scratch coat should first be made by firmly scraping the repair mortar over the base of the substrate surface to form a thin layer (approximately 5 mm) and to fill any deep cavities. The scratch coat must cover the entire surface subjected to repair. After completion of the scratch coat, the repair mortar can be applied in successive layers, always pressing firmly the mortar into the repair area. Unless otherwise stated in the specifications of the material used, when more than one layers of repair mortar are needed, straightening and roughening with a notched trowel shall be performed between subsequent coats and the surface shall be washed and wetted with water before proceeding with the application of the next layer, allowing at least 12 hours to elapse between subsequent coat applications. On vertical surfaces, the mortar layers should build up from bottom to top. The maximum thickness of successive mortar layers shall be 40 mm on vertical surfaces and 20 mm on horizontal surfaces.
- **Wet spray application**: This method can be applied provided that it is prescribed in the specifications given by the manufacturer of the selected material. The apparatus used for the application of the repair mortar shall meet the specifications given by the manufacturer of the material. It is indicatively noted that for the application of cement-based repair mortars, many manufacturers specify the use of piston or worm screw type rendering machines and preclude the use of continuous mixing type rendering machines. If wet spray application is used, the nozzle of the spraying apparatus shall be pointed at a distance of 20 to 50 cm from the surface being treated to ensure uniform layering of the material. Particular attention must be paid to ensure that all voids behind reinforcement bars are filled. For this purpose, the spray nozzle must be pointed at different angles to the surface during application. To achieve adherence of subsequent layers in cases where more than one layer is required to fill the treated area, the surface of the sprayed mortar shall not be too smooth.

(iv) When the area treated area has been completely patched and as soon as repair mortar start to stiffen, the **surface shall be finished using a float** (wooden or PVC trowel recommended). Over-trowelling of the mortar should be avoided as this may lead to surface cracking.

2.2.9.3.3 Protection and curing

Repaired concrete surfaces should be **protected from rain, frost, wind and sun**.

In addition, for curing of the repair mortar to complete effectively, **moisture shall be kept in the mixture for at least 72 hours** (or for a period equal to the curing period stated by the supplier of the mortar), before being allowed to dry out slowly. Acceptable curing and protection methods include wetting of surfaces with water and covering with plastic sheeting, wetted hessian fabric (burlap) or other suitable membrane. If the placement of membranes is not practically feasible and if no

subsequent coating is to be applied on surface the surface a curing agent can be used, subject to the approval of the supervising Civil Engineer.

Repaired concrete surfaces should also be protected from mechanical damage and disturbance taking into account other works in progress, subsequent construction operations and the use of scaffolding or of supporting installations at the areas near the repair.

2.2.10 [S11] CONSOLIDATION AND REPAIR OF MASONRY BY MEANS OF GROUT INJECTIONS

2.2.10.1 Scope and application

The intervention involves the **injection of a flowable lime-based grout into masonry sections** for:

(i) The **repair of cracks with crack mouth opening up to 15 mm.**
(ii) For the **consolation of load-bearing element via the homogenization of mass**.

The aim will be to fill any cracks, or other discontinuities so as to restore the stress-transfer capacity of the masonry and to enhance the compressive and tensile resistance of the load-bearing sections.

The areas of the monastic complex where the implementation of grout injections is initially prescribed and the application method are indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study.

Prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

It is further noted that additional grout injections may have to be conducted in areas where vegetation growing within the mass of the masonry is removed. This shall depend on the type and extent of damage observed after the removal of the plants (see paragraph 2.2.2).

2.2.10.2 Materials

2.2.10.2.1 Grout

The grout material used for the repair and consolidation of the masonry should be lime-based and should possess adequate rheological properties to ensure injectability and stability against sedimentation.

It is recommended that the fresh mixture has an efflux time of ≤ 30 s as measured by the flow cone tests prescribed in EN 445 for assessing the fluidity of grouts. In addition, the mechanical properties of the grout should be appropriate for ensuring adequate stabilization of the masonry. Therefore, the compressive strength of the hardened mixture at 28 days as determined in accordance to EN 1015-11 must be ≥ 10 MPa.

The grout can be of the commercial type ***'Mape-Antique I-15'***or ***'Kimia Limepor 100'*** *or* ***'LIME INJECTION 9000'***.

The use of other commercially available **products with equivalent characteristics** is permitted. If a commercially available product is to be used, prior to the initiation of works, the contractor must provide samples of the intended mortar material **subject to approval by the supervising Architect**

and Civil Engineer. In case a commercial grout is selected, the application instructions of the manufacturer should be followed in detail.

The **use of purposely designed grout slurries is also permitted**. Such mixtures should be made from Natural Hydraulic Lime of grade NHL3.5 or NHL5 and may contain natural or artificial pozzolans and/or filler material and/or ultra-fine sand (grain size ≤ 100 μm) and/or admixtures for enhancing fluidity. The binder material can be of the commercial type ***'Limepor NHL3.5'*** or '***Lafarge NHL3.5'*** or ***'Saint-Astier NHL5'*** or ***'SECIL NHL5'*** and should satisfy the specifications set in EN 459-1. The use of other **products with equivalent characteristics** is permitted, subject to approval by the supervising Architect and Civil Engineer.

The use of carbonate filler and of silica sand of appropriate grading is also recommended. In case a purposely made grout mixture is used, prior to the initiation of works, the **Contractor should prepare trial mixes and perform standardized laboratory tests** as per EN 1015-11 and EN 445 in order to prove that the proposed material meets the fluidity and strength specifications hereby prescribed.

2.2.10.2.2 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

Fillerized grout materials and/or binders delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost.

Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.

2.2.10.3 Methodology

2.2.10.3.1 Preparatory actions

(i) Before the application of grouting, the **exiting coatings of the masonry surfaces that will be treated should be manually removed**.

- In the case of walls which will be consolidated, the surface that will be treated must be without coating.
- In the case of cracks, the coating material must be removed at a width of 15-25 cm on either side of the crack path.

For the execution of such works reference is made to the relevant technical specification, while particular note is made to the implementation of measures for the protection of historic plasters/renders.

(ii) The masonry substrate should then be prepared by **cutting out deteriorated mortar from the joints and/or the crack paths** and by **thoroughly cleaning the surface** to remove all traces of materials and substances which could compromise adhesion of the repair products. Regarding the latter, low-pressure hydro-cleaning can be applied.

(iii) Afterwards, injection tubes shall be installed at the areas of the masonry to be consolidated or along the paths of cracks that will be injected.

- To facilitate the installation of the tubes/injectors, **20-40 mm diameter holes extending to a depth of 1/3 - 1/2 of the thickness of the masonry should be drilled**.

(iv) When grouting is applied for the homogenization of masonry, the tubes shall be installed throughout the surface of the section at a pitch of 50 x 50 cm. In such cases, and where practically feasible, tubes shall be installed on both faces of the masonry section. When the grouting is applied for crack repairs, the tubes shall be installed along the entire length of the crack path at regularly spaced intervals of 30-50 cm. If the cracked recorded extents throughout the thickness of the section, injection tubes shall be installed on both faces of the masonry.

- It is recommended to **use rubber tubes of appropriate size and a wall thickens** adequate to sustain the pressure generated during grouting. In any case, the tubes used should be clear (i.e. transparent and not colored) to enable monitoring of the grout filling process. The tubes inserted in the masonry should protrude sufficiently from the face of the section to be treated to enable connection to the nozzle of the injector apparatus. The recommended protruding length is at least 50 cm.
- The **tubes that will be used for the application of the grouting material shall be fastened at the drilled holes using the lime-based mortar** hereby specified for the implementation of repointing works.
- The **area along the perimeter of the tubes/injectors and along the masonry joints and/or crack paths shall be completely sealed with mortar** to prevent leakage during the application of the grout slurry.

(v) The Contactor must prepare diagrams marking the positions of all tubes/injectors installed on site and shall provide consistent coding/numbering for all injection positions. The latter shall depend on the sequence of the grouting procedure (i.e. starting the numbering from the points where the grout will initially be injected and moving upwards) and shall be decided in collaboration with the supervising Civil Engineer.

(vi) In areas where grout injections will take place close to historic floors any other special elements of the Monastery, these surfaces must be covered using appropriate protective layers.

2.2.10.3.2 Execution of works

Mixing of the grout material shall be carried out using suitable mechanical equipment. Mixing by hand is **not** permitted. The mixing apparatus used, and the mixing time and rate shall depend on the instructions given by the supplier of material and shall be such that sufficient fluidity is attained without deflocculation (recommended mixing apparatuses: electric drills with suitable mixing attachments; recommended mixing time: 5 min). The grout slurry must be used before its workable life has expired. An indicative value of the maximum working life for lime grouts is 60 min. Any grout left after the initial set has commenced should be discarded and should not be reconstituted. Mixing and application of grout in excessively cold ($T < 5^oC$) or hot ($T > 38^oC$) weather conditions should be avoided as this can affected the fluidity and end-performance of the material.

(i) To prevent excessive mitigation of moisture from the fresh grout, the **core of the masonry section that will be consolidated or repaired should first be saturated**. For this purpose, the day before injecting the slurry, water shall be injected through the tubes/injectors fastened in place. Injection of water shall start from the holes in the highest position and will be completed only after the treated masonry section has absorbed all the water.

(ii) Prior to the initiation of grout injection works, the contractor must perform a **trial application involving the repair of one cracked section** that should be inspected and be subject to approval by

the supervising Architect and Civil Engineer. Grout injection works can commence only after the trial application is considered successful and the contractor has identified and marked all positions where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.

(iii) Following saturation of the masonry, the **grout material may be injected using a low pressure continuous flow pump**. The use of both electric and electronic pumps is permitted. In any case the pump used shall incorporate systems that enable controlling and monitoring the pressure at the injecting nozzle, with appropriate accuracy in respect to the pressure values hereby noted. Moreover, the pump that will be used shall be equipped with a valve capable of obstructing the rising of pressure over the limit hereby specified. During the execution of works this **pressure shall be kept constantly ≤ 0.10 MPa** (i.e. 1 atmosphere). The pumping system must incorporate filters at the pump extraction output and/or the injection nozzle that will prevent the passage of any alien particles or lamps.

(iv) Grouting should **start from the bottom working upwards** to help expel air in the structure and achieve adequate filling of all cavities. Injection at a certain point should **stop only when the slurry seeps out of a tube near the one being used and/or the pressure at the injection point reaches 0.1 MPa**. At this stage, the tube being used should be sealed and the operation should continue from the tube from which the slurry seeped out. This procedure/pattern should be followed until the entire area of the surface or the entire length of the crack has been treated and the grout seeps out of the tube/injector at the highest point of the structure. Any slurry spilled on the historic fabric during the works must be cleaned as soon as practicable, and preferably before it hardens.

(v) In the course of grout injection interventions a **monitoring protocol must be established by the Contractor**. This should include recording of the information listed below:

- Code/number of point injected and of the corresponding point where the grout seeped out.
- Volume of material injected per injection point.
- Any significant variations of injection pressure or of grout consumption noted during the implementation of works.

(vi) Upon completion of the consolidation procedure, all **tubes/injectors shall be removed and the holes/joints shall be filled with lime-based mortar**. This work shall be carried out in accordance with the specifications given for the repointing of masonry.

2.2.10.3.3 Protection and curing

In the case of homogenization interventions it is recommended to carry out grouting for a day and then interrupt the procedure for approximately 24 hours to allow de-watering and reduction in volume to take place before continuing.

Crack repairs, on the other hand, should not be interrupted and should be carried out in continuous grouting applications.

Grouted masonry surfaces should be protected from mechanical damage and disturbance taking into account other works in progress, subsequent construction operations and the use of scaffolding or of supporting installations at the areas near the repair.

Any additional loads can be imposed on grouted sections only when sufficient maturing of the grout material has been achieved (i.e. at least one week after completion of the final injection).

2.2.11 [S12] COVERING OF FLOORS WITH GRANULAR MATERIAL

2.2.11.1 Scope and application

The works hereby described refer specifically to the **covering of floors in Blocks A and C so as to protect the historic floor fabric and create drainage inclinations**. These floors shall be covered by layers of materials consisting of a sub-base composed of compacted sand rich in fines and a top stratum of compacted fine gravel. The area of application is indicated in the drawings of the tender documents.

2.2.11.2 Materials

2.2.11.2.1 Sand

The material used for the construction of the base stratum of the covering layer shall be **sand with a maximum particle size of 4 mm**. The sand must be rich in fines so that the material will acquire adequate cohesion upon wetting and compaction.

The sub-base material can be any **sand with equivalent characteristics**.

In case adequate cohesion cannot be achieved by the fines incorporated in the material alone, this shall be realized by the **addition of lime**.

Prior to the initiation of any works, the **Contractor must provide samples** for the intended sand material **subject to approval by the supervising Architect and Civil Engineer**. The supervising Architect and Civil Engineer can additionally request data concerning the properties (e.g. granulometry, fineness modulus, absorption, etc.) of the intended material if they consider necessary.

2.2.11.2.2 Gravel

The material used for the construction of the top stratum of the covering layer shall be **limestone fine gravel of grain size 2-6 mm and white/beige colour**.

The gravel must be clean and well graded, free of clay, silt and organic matter. The gravel shall also be thoroughly washed to remove any fines.

Prior to the initiation of any works, the **Contractor must provide samples** for the intended gravel material **subject to approval by the supervising Architect and Civil Engineer**. The supervising Architect and Civil Engineer can additionally request data concerning the properties (e.g. granulometry, fineness modulus, absorption, etc.) of the intended material if they consider necessary.

2.2.11.2.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.

2.2.11.3 Methodology

2.2.11.3.1 Preparatory actions

Works for the **covering of floors can be carried out only after the completion of all other interventions** in the particular structure to be treated.

(i) Prior to the initiation of any such works, the Contractor must **identify and mark all areas to be covered**.

(ii) These shall be inspected by the supervising Architect and Civil Engineer, the consent of whom is required for proceeding with the works.

(iii) It is noted that the construction of the covering layer cannot be based on a standard drawing, since the thickness and of the laid strata must vary in order to adapt to the level and nature of the ground of each area. In any case, the placement and finishing of the granular material must be such that an inclination of 3% to 5% towards the indicated drainage side is achieved.

- For this purpose, in the preparatory phase, **string lines and/or marked boning rods and/or sight-rails can be installed to guide the laying of the materials** and to help achieving the specified inclinations. In areas where the construction configuration of the floor is such that the granular materials cannot be restrained (e.g. presence of door openings or gaps), **edge restraints composed of timber planks 20-25 mm thick shall be installed**. After the covering layer has been applied and compacted and has attained adequate cohesion to retain the desired geometry, any edge restrains shall be removed.

2.2.11.3.2 Execution of works

(i) Covering of the floor shall initiate with the **laying and spreading of the sand**. The sand must be evenly distributed to all parts of the treated area manually using timber or aluminum spreaders and/or shovels.

(ii) After an adequate amount is spread into the entire area, this shall be **wetted with water and compacted** using suitable equipment until it gains sufficient cohesion.

- It is noted that the choice of hand-held single direction plate compactors suitable for shallow lifts (< 30 cm) of sand and gravel are deemed to be appropriate.
- The **final thickness of the compacted sand layer shall be in the region of 5-30 cm**, depending on the recesses of the surface to be covered and the intended inclination to be achieved.

(iii) The **Contractor must inform the supervising Architect and Civil Engineer on the intervened compaction equipment and obtain their consent** before proceeding.

(iv) Upon the completed sand layer, the gravel material shall be spread, again using spreader components and/or shovels. The gravel layer shall also be compacted using equipment approved by the supervising Architect and Civil Engineer.

- The final thickness and layout of the gravel layer will be such that the drainage inclinations hereby specified are achieved. It is anticipated that the **minimum of the gravel layer shall be 5 cm**.

2.2.12 [S13] PAINTING OF COATINGS

2.2.12.1 Scope and application

Painting the outside of specified - on- drawing building surfaces, requires the Clients consent as this affects the special architectural or historic character of the building.

Previously unpainted surfaces should not normally be painted over. In formal approval by the client, the specified - on- drawing building surfaces **should be painted only with the careful specification of paint type and colour which is approved by the Historic Buildings Association**.

The official paint proposed for Historic Buildings is the Limewash and Lime-Paint.

2.2.12.2 Methodology

Old buildings porous nature allows water absorbed by the fabric to evaporate back out. As a result lime-based materials should be used as they allow structures to breathe. In contrast modern cement is an impervious product that forms waterproof barriers that restrict evaporation, and is therefore an inappropriate material for use in old buildings.

Limewash is a simple type of paint made from lime and water, and is available in various colours. It will benefit the buildings solid walls as it allows it to breathe and retains the texture of any underlying stone. It can be used externally and internally and is suitable over lime plaster or render, earth and stone walls, timber and most old limewash.

Limewash Pure is the simplest and cheapest paint available. Basic limewash is white, but a beautiful range of colours can be made by adding pigments such as ochre and raw sienna.

(i) Before applying limewash **the wall should be sprayed with water so that it is damp when the paint is applied**.

(ii) Apply **limewash. It hardens in the same way as lime mortar - by absorption of carbon dioxide from the atmosphere, which combines with the lime (calcium hydroxide) to form calcium carbonate, binding the lime wash to the substrate.**

(iii) Limewash must dry out very slowly to ensure that it has fully carbonated.

(iv) It should be applied in several thin coats - usually 3 or 4 coats are needed. If it is applied thinly and allowed to dry out slowly it will form a durable paint, which will not come off easily.

- Coloured limewash can be affected by variations in the substrate resulting in subtle variations in tone that is part of its charm.
- **It can be painted directly onto stonework and it is highly permeable, copes well with condensation, inhibits mould growth and is suitable for walls subject to low levels of rising damp as it can allow water to evaporate harmlessly**.
- Lime washed surfaces have a soft chalky appearance that refracts light and gives a real depth of colour not found in other paint types.

2.2.13 [S14] REPLACEMENT OF DAMAGED TIMBER BEAMS

2.2.13.1 Scope and application

The works hereby described refer specifically to the **replacement of damaged timber beams** from specified - on- drawing building structures.

The intervention methodology involves the **replacement of all timber beams of the floor of this structure that exhibit excessive deflections, cracking, fracturing and/or rot damage and the removal of all loose floor overlays**.

The objective will be to restore some degree of load transfer capacity between the two longitudinal walls of the structure that support the floor beams and to preclude accidents caused by debris falling from the loose overlays. The application method is indicated in the drawings of the tender documents.

2.2.13.2 Materials

2.2.13.2.1 Timber sections

- All replacement timber elements used shall be composed of **C18 class softwood** in accordance to the specifications set in EN 338.
- The cross-sectional dimensions of **members used for the replacement of existing building components shall resemble those found on site**. The latter have a circular cross-section of approximate diameter 12 cm. The new elements shall have a diameter ≥ 12 cm. Their cross-sectional dimensions shall not exhibit considerable deviations along their entire length; the acceptable deviation of the diameter is hereby defined as ≤ 10%.
- In case the cross-sectional dimensions of the members to be replaced preclude the use of standardized wood products, the **use of other timber materials resembling those on site may be considered**.
- Only the **use of sorted timber** is permitted. The use of timber members with imperfections and/or defects (i.e. knots, shakes, twisted/torn fibers, splits, rind galls, burls, shrinkage deformations, chemical strains, druxiness, rot, sap, signs of insect infestation) is not acceptable.
- In any case, the **Contractor must provide experimental results or specification sheets for the selected materials** indicating that their mechanical properties are equivalent or superior to those of class C18 structural timber.
- All timber elements used shall be **pre-treated with a suitable wood preservative** to address potential damage by dry/wet rot and from wood destroying insects. Pressure treatments with Chromated copper arsenate (CCA) compounds and immersion treatments with creosote compounds are acceptable.
    - The selected material must leave no surface residues after treatment, must be non-staining and should be capable of receiving additional treatment coatings or paint overlays in time.
    - The wood preservative can be of the commercial type ***'Wykamol Wykabor 20.1'*** or ***'ProBor 20'***. The use of **other commercially available products with equivalent characteristics** is permitted.
    - Prior to the initiation of works, the Contractor must provide samples and specifications of the intended wood preservative compound **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer of the compound should be followed in detail.

- Then, the timber elements shall **receive 4 coatings of clear mat varnish suitable for outdoor use**. The varnish can be of the commercial type ***'International Clear Wood Sealer Fast Dry'*** or ***'Sadolin Outdoor Varnish'*** or ***'Ronseal Yacht Varnish'***.
    - The use of **other products with equivalent characteristics** is permitted, subject to approval by the supervising Architect and Civil Engineer.
    - Prior to the initiation of works, the Contractor must provide samples and specifications of the intended topcoat material **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer of the compound should be followed in detail.

2.2.13.2.2 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

Timber members should be stored under a roofed (preferably enclosed) space.

Timber should be stacked on pallets to maintain its flatness. There should be adequate room space for good air circulation around stacks.

If timber is stored in enclosed space, this should be well ventilated.

2.2.13.3 Methodology

2.2.13.3.1 Preparatory actions

Prior to the initiation of any works, the **Contractor must identify and mark in collaboration with the supervising Architect and Civil Engineer all timber beams that shall be replaced**.

Works for the replacement of damaged timber beams should be carried out after **proper temporary supports have been installed to make the working area safe**.

For this purpose, the **Contractor must submit in advance a method statement** clearly describing the intended course of action that will be implemented on site for the replacement of the beams and for the support of the nearby structures.

Works may commence only after this method statement has been approved by the supervising Architect and Civil Engineer.

Inspection and approval of any supports/props installed on site to facilitate the replacement of beams is also a prerequisite for the initiation of such works. Preparatory actions should include **complete removal of all floor overlays**.

2.2.13.3.2 Execution of works

(i) Damaged beams to be replaced shall be cut and removed progressively in sections, providing adequate support to avoid damage for the masonry.

(ii) The **embedment areas where the abutments of the removed beams rested shall be cleaned thoroughly**, removing any masonry materials that are deteriorated, cracked, flaky, particularly loose and/or poorly bonded. The area of the embedment section may be enlarged to accommodate the installation of the new beams.

(iii) The new beams shall be set in place and supported by means of mechanical props. The thread head of the prop shall be adjusted so that the lower part of the beams is raised above the intended final position.

(iv) As the beams are still raised, a bedding course of masonry shall be constructed. Reference is made to the specifications given regarding the reconstruction of masonry sections for the implementation of this work.

(v) After the jointing mortar of the reconstructed course hardens and develops adequate strength (typically > 7 days after application), the beams shall be lowered to place but shall still be supported by propping.

(vi) At this stage any **interstices between the masonry and the perimeter of the beam shall be completely filled with lime mortar and pieces of stone**. Again reference is made to the specifications given regarding the reconstruction of masonry sections for the implementation of this work.

(vii) When the mortar of the reconstructed part is matured, propping may be removed.

- During or after the execution of works for the replacement of timber beams, the supervising Civil Engineer holds the right to instruct the implementation of grouting at the abutments of the beams if he/she considers that this is required for achieving adequate connection between these members and the surrounding stonework.
- The intervention implemented shall ensure that **at least one sound beam exists every 1 m length of wall**.

(viii) The new beams installed, as well as the existing beams retained shall be interconnected using timber planks of cross-sectional dimensions 20 x 200 mm.

- The planks shall be placed in the transversal direction among the parallel beams and shall be fastened using stainless steel fixings approved by the supervising Civil Engineer.
- The planks shall extend along the entire length of the floor structure, ensuring that all timber beams are connected together.
- Series of planks shall be placed every approximately 60 cm (center to center) and in any case at the two ends and the center of the floor structure.

2.2.14 [S16] INSTALLATION OF DRAINAGE CHANNELS

2.2.14.1 Scope and application

The works hereby described refer to the **replacement of drainage channels in the courtyard**, in case these are found to be damaged during inspection and cleaning.

2.2.14.2 Materials

2.2.14.2.1 Drainage channel system along the main entrance

The drainage channel shall be constructed using custom made channel with grades which meet the requirements set in EN 1433 for Class B125. The channel should have nominal dimensions (width x length) 70x40 cm and should be suitable for exterior use. The drainage channel will collect the drain water gathering from the corridor and rooms of Block C, via 4 plastic pipe segments with a diameter of 300 mm and a total gross cross section 0.30 sq.m.

The water will be drained towards the exterior of the monument via 6 plastic pipe segments with a diameter of 300 mm and a total gross cross section 0.42 sq.m. The pipes shall be placed as a formwork to create the round drain outlets from drainage tunnel. At the external face metal frames with metal wire-mesh shall be placed to maintain drainage channel free from animals and debris.

Prior to the initiation of works, the **Contractor must provide samples and specifications of the intended drainage channel system subject to approval by the supervising Architect and Civil Engineer**.

2.2.14.2.2 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. The elements and fixings of drainage channels should be stored under a roofed (preferably enclosed) space protected mechanical impact.

2.2.14.3 Methodology

2.2.14.3.1 Preparatory actions

The drainage channels shall be fitted on the instructed positions after **removing the existing ground slab**. Reference is hereby made to the relevant technical specification describing the execution of this work.

After cutting and removal of the concrete, a **trench shall be dag using hand-held tools** (i.e. shovels) to accommodate the placement of the channel.

2.2.14.3.2 Execution of works

Following the formation of the placement trench, **a bedding layer of concrete minimum 50 mm thick shall be laid** along the entire length of the placement area. Marking strings shall be used to guide the placement of concrete and of the drainage channel.

The **channels shall then be assembled and set in place** onto the concrete bed. Placement of the drain channels shall ensure that adequate drainage inclinations are formed (i.e. minimum 3%). In case the selected drainage channel system does not have a self-adjusting mechanism for the formation of inclinations, the inclinations shall be created with the bedding concrete.

After placement of the channel, the **voids between the exterior surface of the channel and the trench shall be filled with concrete and the surface of floor shall levelled** with a trowel. Finally, the **gratings shall be placed** to complete the installation and the **system shall be tested to ensure its proper function**.

2.2.15 [S17] INSTALLATION OF STEEL TIE RODS

2.2.15.1 Scope and application

The works hereby described refer specifically to the **installation of steel tie rods** at specified - on-drawing - building segments **for the repair of separation cracking**.
The steel ties shall extend along the length of the transversal walls and will connect the two longitudinal walls of the structure.
Installation of the steel ties must be preceded by grouting of the cracked sections. The areas where steel ties will be installed and the construction details are indicated in the drawings of the tender documents. The exact positions of the steel ties shall be indicated by the supervising Civil Engineer on site.

2.2.15.2 Materials

2.2.15.2.1 Stainless steel tie system

The steel tie system installed in each position indicted shall consist of the following members:

- **Anchor plates:** These shall be placed on the exterior side of the masonry wall and shall incorporate holes to facilitate the placement of tensioning anchor bars and load nuts. At each position 2 (i.e. 1 per wall) **UPN 240 sections composed of S275 structural steel** shall be used. The sections will be sufficiently long to enable placement of tensioning anchor bars on extending on either side of the transversal wall between the walls that shall be tied. The UPN 240 sections must have pre-drilled holes at appropriate positions to enable the installation of 20 mm diameter bars and the fixing of M20 load nuts.
- **Load-distribution plates:** These shall be placed between the masonry wall and the anchor plates and shall be adequately stiff to enable constant pressure distribution at the positions where the ties will be installed. At each position 2 (i.e. 1 per wall) **20 mm thick plates composed of S275 structural steel** shall be used. The dimensions of the plates shall be such that these protrude from all sides of the UPN anchor plates. In any case the plates shall have a length ≥ 1200 mm and a height ≥ 300 mm. The plates must have also have pre-drilled holes at appropriate positions to enable the installation of 20 mm diameter bars.
- **Tensioning anchor bars:** These shall be installed in holes drilled on the longitudinal walls and shall be used for tensioning the tie system. At each position 4 (i.e. 2 per wall) **full thread high strength stainless steel bars of 20 mm diameter** shall be used. Each stainless steel full thread bar must have a load bearing capacity greater than 120 kN and a length sufficiently greater than the thickness of the wall to allow correct placement.
- **Attachment pins:** These shall be fitted onto the tensioning anchor bars and shall be used as connectors for attaching the tension members. At each position 4 (i.e. 1 per anchor bar) **stainless steel clevis with pins** shall be used. The clevises must incorporate threaded hole ends so that they may be fastened on the anchor bars.
- **Tension members:** These shall be attached to the anchors bars using the clevises and will be subjected to post-tensioning in order to produce a confinement effect between the masonry walls. At each position 2 **stainless steel wire ropes of 16 mm diameter** shall be used. Each stainless steel stainless steel wire rope must have a minimum breaking force greater than 120 kN and a length adequate to allow correct placement between parallel longitudinal walls. In addition, both ends of the wire ropes **must incorporate turn-back eye ferrules** meeting the requirements set in EN 13411-3. The ferrules shall have stainless steel cylindrical conical terminators, as well as stainless steel thimbles.
- **Load nuts:** these shall be used for locking the anchor bars into place and for imposing post-tensioning on the tension members. At each position 4 (i.e. 1 per anchor bar) **M20 stainless steel hexagonal load nuts with a length of at least 30 mm shall be used**. The nut fittings must have the capacity to provide a strength of anchorage equal to the theoretical minimum required by the threaded bars (i.e. 120 kN).

Prior to the initiation of works, the **Contractor must provide samples and specifications of the intended members and fittings that will compose the tie system subject to approval by the supervising Architect and Civil Engineer**.

2.2.15.2.2 Anchor plate bedding mortar

Since the rubble stone masonry upon which the anchor plates are placed has an uneven surface, a bedding layer of mortar shall be used to enable the uniform transfer of stresses along the length of the tie system's supports. The bedding material shall be a high strength (≥ 45 MPa at 28 days as EN 12190) pre-batched shrinkage-compensated mortar suitable for fillings, anchoring and grouting of steel plates.

The mortar can be of the commercial type ***'SikaGrout-312 HP'***. The use of **other products with equivalent characteristics** is permitted.

Prior to the initiation of works, the contractor must provide samples and specifications of the intended bedding mortar material **subject to approval by the supervising Architect and Civil Engineer**. The application instructions of the manufacturer should be followed in detail.

2.2.15.2.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

Steel members should be stored under a roofed (preferably enclosed) space protected from moisture and mechanical impact.

Pre-blended mortars delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost.

2.2.15.3 Methodology

2.2.15.3.1 Preparatory actions

Prior to the initiation of any works, the **Contractor must identify and mark in collaboration with the supervising Civil Engineer the positions where the ties shall be installed**.

Before proceeding to the installation of the ties the Contractor must **install proper temporary supports to make the working area safe**.

Any separation **cracks between the walls to be tied shall be repaired by means of grout injections** (see paragraph 2.2.10).

After the completion of grout repairs and the adequate maturing of the injected material, works for the installation of the tie system may commence.

Preparation for the installation must include thorough cleaning of the masonry substrate upon which the anchor plates will be placed. The masonry must be free from dust, dirt, loose material and any other agent that by prevent the positioning of the anchor plates.

In case, parts of the masonry are found to exhibit any damage (e.g. weathering of mortar, fracturing of stone, etc.) these must be repaired before proceeding with any other works (see paragraph 2.2.6 & 2.2.7).

2.2.15.3.2 Execution of works

(i) Installation of the tie system shall initiate with the **drilling of holes extending throughout the thickness of the masonry walls to be connected in order to enable placement of the tensioning anchor bars**.

(ii) The holes drilled shall be cleaned with water and/or compressed air and **plastic tubes of appropriate size shall be fitted with mortar in the holes** to accommodate placement of the anchor bars.

(iii) Prior to the application of the mortar it is recommended to pre-wet the masonry substrate.

(iv) The mortar used for fitting the plastic tube into the holes can be other same type as that specified for the repointing of the masonry (see paragraph 2.2.6).

(v) Afterwards **the anchor bars fitted with the clevises shall be inserted into the plastic tubes**. The pre-drilled **load-distribution plates and anchor plates shall be positioned** based on the projecting parts of the anchors bars and shall be loosely fixed in place using the load nuts. The **gap between the load-distribution plates and the masonry substrate shall be completely filled with the selected bedding mortar**.

(vi) The freshly applied mortar shall be protected from early dehydration for a period of at least 24 hours using a suitable method such as jute and water, plastic sheets or other suitable membranes.

(vii) Placement of the tension members and post-tensioning shall be carried out only after the bedding mortar of the anchor plates has gained adequate strength. This period shall depend on the properties of the selected mortar, but in any cases a minimum of 7 days should be allowed.

(viii)The stainless steel wire rope **tension members may then be set in place and secured into the clevises with the pins**. **Tensioning of the wire ropes** can be carried out using a hydraulic torque wrench or other similar device approved by the supervising Civil Engineer. The apparatus used must be equipped with a pressure gauge to enable the monitoring of the exerted stresses. The maximum permissible stress to which the tie rod systems shall be tensioned will be instructed by the supervising Civil Engineer

2.2.16 [S18] CONSTRUCTION OF STEEL STRUCTURES

2.2.16.1 Scope and application

The works hereby described refer to the **construction and installation of new steel structures within the Monument**. These include the:

(i) The addition of **steel truss frame structures** for the structural strengthening of the load-bearing system.

The methodology of installation and details of these structures are indicted in the drawings of the tender documents.

2.2.16.2 Materials

2.2.16.2.1 Steel

Unless otherwise specified in the construction drawings, all steel members shall be composed of **S275 grade structural steel**.
Unless otherwise specified, all steel members used shall have a **protective paint system consisting of a primer coat, 2 undercoats and 1 finish coat** (i.e. primer plus 3 paint coats).

Painting of the steel sections must be carried out at the shop, before these are transferred on the site.

Unless otherwise specified in the construction drawings, **welded connections between steel members shall be continuous fillet weld 7 mm thick**. All members shall be **welded and drilled at the shop**, before being transferred to the site. Welding or drilling of members at the site is not permitted, unless specific instructions are given by the supervising Civil Engineer.

2.2.16.2.2 Fixings

Unless otherwise specified in the construction drawings, **all bolts, screws, anchors or studs used for the connection of steel members shall be of class 8.8 or superior** and shall meet the requirements of EN ISO 898.

All **fixings used must be zinc-coated or stainless steel**, as the intended steel structures will be exposed to the weather.

For the particular case of the anchorage between the steel truss frame in Block C and the masonry walls, **full thread high strength stainless steel bars of 20 mm diameter** shall be used. Each stainless steel full thread bar must have a load bearing capacity greater than 120 kN and adequate length to allow correct placement.

2.2.16.2.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. Steel members and fixings should be stored under a roofed (preferably enclosed) space protected from moisture and mechanical impact.

2.2.16.3 Methodology

2.2.16.3.1 Preparatory actions

Prior to the fabrication of steel members and the initiation of any installation works, the **Contractor must carry out accurate on-site measurements** to record the exact dimensions of the locations to which metal fabrications must fit.

The **Contractor must submit the recorded measurements, as well as structural calculations and complete shop drawings for all steel structures** to the supervising Architect and Civil Engineer the consent of whom is required for proceeding with the fabrication of these structures.

For any particular case of steel truss frame structure application, the **Contractor must submit a method statement** clearly describing the intended course of action for the installation of the structure and the support of the nearby structures.

Works may commence only after the shop drawings and the aforementioned method statement have been approved by the supervising Architect and Civil Engineer.

2.2.16.3.2 Execution of works

All **steel construction works shall be executed in accordance to EN 1090** standards.
Only bolted connections and anchorages shall be executed on site, unless specific instructions stating otherwise are given by the supervising Civil Engineer.

Historic fabric close to steel structures installation areas shall be adequately protected during the execution of works.

For the particular case of the steel truss frames that will be installed and anchored onto the walls, preparatory actions for the compaction of the ground upon which the footings will be placed and for the identification of the anchoring points must be carried out.

All **footings shall be placed above ground level** and no excavations shall be performed.

The **ground upon which the footings shall be placed must initially be compacted**.

The Contractor must inform the supervising Architect and Civil Engineer on the intervened compaction equipment and obtain their consent before proceeding.

It is noted that the choice of hand-held tamping rammers suitable for the compaction of cohesive and mixed soils is deemed to be appropriate.

The **base beams of the truss frames shall rest upon timber beams with a minimum cross-sectional thickness of 20 mm** that must be placed firmly on the compacted ground.

Regarding the **anchoring points of the frames, these must be positioned in places where there is rubble stone masonry and where decorated architectural elements (e.g. carved stones, arches, etc.) are not affected**.

Drilling for the installation of the steel truss frame fixings shall be executed after the intended anchoring positions have been inspected and accepted by the supervising Architect and Civil Engineer.

At the interfaces between the masonry walls and the steel truss frame structure, timber planks of 50 x 200 mm cross-section shall be installed to accommodate for surface unevenness of the masonry and to enable interconnection of the stiffening frames and walls along the transversal direction.

2.2.17 [S19] WATERPROOFING OF STONE MASONRY SURFACES

2.2.17.1 Scope and application

The works hereby described refer specifically to the **waterproofing of the vaulted roof**.

The exterior surface of this roof structure shall receive a coating of render which will be waterproofed using a compatible cement-free material.

The area of application is indicated in the drawings of the tender documents.

2.2.17.2 Materials

2.2.17.2.1 Render coating mortar

The waterproofing material shall be applied on top of a render coating layer. The material used for the construction of this layer should be a general purpose mortar for external render based on Natural Hydraulic Lime. The material should satisfy the requirements set in EN 998-1 for rendering and plastering mortars of Categories CS IV and W2 (i.e. compressive strength at 28 days ≥ 6 MPa and capillary water absorption ≤ 0.2 kg/m^{2}min$^{1/2}$). The mortar can be of the commercial type ***'Mape-Antique Strutturale NHL'***. The use of **other commercially available products with equivalent characteristics** is permitted.

If a commercially available product is to be used, prior to the initiation of works, the contractor must provide samples and specifications of the intended mortar material **subject to approval by the supervising Architect and Civil Engineer**. In case a commercial mortar is selected, the application instructions of the manufacturer should be followed in detail.

The **use of purposely designed mortar mixtures is also permitted**. Such mixtures should be made from Natural Hydraulic Lime of grade NHL5 mixed with natural sand aggregates of grading 0-4 mm. The binder material can be of the commercial types **'*Saint-Astier NHL5*'** or **'*SECIL NHL5*'** and should satisfy the specifications set in EN 459-1.

The use of **other products with equivalent characteristics** is permitted, **subject to approval by the supervising Architect and Civil Engineer**.

The aggregates used for the composition of the mortar should be sharp sand, clean and well graded, free of clay, silt and organic matter. The use of local calcareous sand aggregate is recommended. The recommended **proportions of the mortar mixture are (lime: sand) 1:2 to 1:2½ vol./vol**.

In case a purposely designed mortar mixture is used, prior to the initiation of works, the **Contractor should prepare trial mixes and perform standardized laboratory tests** as per EN 1015-11 and EN 1015-18 in order to prove that the proposed material has a compressive strength at 28 days ≥ 6 MPa and a capillary water absorption coefficient of ≤ 0.2 kg/m^{2}min$^{1/2}$.

2.2.17.2.2 Mesh reinforcement for render coating

To prevent the formation of cracks, the render coating layer shall be reinforced with an alkali-resistant glass fiber mesh system suitable for the strengthening of structural render.

The mesh system selected must be complemented by non-metallic connectors/fasteners. The mesh can be of the commercial type **'*Mapegr EM30*'** or **'*Mapenet EM40*'** or **'*ADFORS Vertex G120*'**.

The use of other commercially available **products with equivalent characteristics** is permitted. In case a material other than those specified here will be used, the contractor must provide samples and specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.17.2.3 Waterproofing material

The waterproofing material shall be a cement-free, elastic lime-based coating product.

The material should also be suitable for mechanical application by spraying or for manual application by brush, roller or spreader. The material can be of the commercial type **'*Mape-Antique Ecolastic'***.

The use of **other commercially available products with equivalent characteristics** is permitted. In case a material other than those specified here will be used, the contractor must provide specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.17.2.4 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

Binder materials and/or pre-blended mortars delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost.

Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.

Waterproofing materials must be stored in accordance to the specifications of the manufacturer and preferably in their original packaging and in a dry area.

Glass fiber meshes should be stored in a clean and dry place without being exposed to UV radiation.

2.2.17.3 Methodology

2.2.17.3.1 Preparatory actions

Preparatory works for the application of the render coating layer should include thorough cleaning of the exterior roof surface to remove dust, mold, efflorescence/salts and any other material that may impair adhesion of the mortar.

- For this purpose, low pressure hydro-cleaning and/or cleaning with pressurized air can be applied.

Voids and uneven areas of the substrate must be repaired by patching or tacking with the same mortar as that used for the construction of the capping or that specified for repointing works, using also pieces of stone with similar characteristics to the original material.

Repointing and/or patching of the substrate shall be applied following the corresponding technical specifications hereby given (see paragraph 2.2.6). Such works shall aim at closing any cracks, fissures or voids and must result to the creation of a sound and compact working surface.

- In case any cracks are detected on the working surface these shall be repaired by means of grout injections or localized reconstruction, depending on their extent (see paragraph 2.2.6).

After the cleaning and repair of the substrate, a series of holes should be drilled (4-5 holes per 1 m^2) to facilitate the installation of fasteners/connectors that will hold the reinforcement mesh is place. The diameter of the holes will depend on the size of the fasteners/connectors complementing the selected mesh system.

The fasteners/connectors shall be set into the holes using a cement-free material specified by the supplier or manufacturer of the mesh system and approved by the supervising Civil Engineer.

- The placement of shims or other installations on the working surface to guide the application of the render coating material is permitted.

2.2.17.3.2 Application of render coatings

Mixing of the rendering mortar shall be carried out using a suitable mechanical mixer.

The mixing time shall depend on the instructions given by the supplier of the binder material or of the pre-blended mortar composition and shall be such that sufficient workability is attained without segregation (recommended mixing time 3-5 min).

Mortar must be used before its workable life has expired. An indicative value of the maximum working life for lime renders is 45-60 min. Any mortar left after the initial set has commenced should be discarded and should not be reconstituted. Mixing of mortar in excessively cold ($T < 4^oC$) or hot ($T > 38^oC$) weather conditions should be avoided as this can affected the workability and end-performance of the capping material.

(i) Following the preparation of the substrate, the **exterior roof surface should be saturated** to prevent the masonry materials drawing water from the render, thus compromising its final performance characteristics.

- Any excess water after wetting of the substrate must be left to evaporate so that the masonry is saturated and the surface is dry.
- Compressed air may be used to speed up this process. The application of rendering mortar should always start from the lower part of the vaulted roof to be coated and continue by working upwards.

(ii) A **5 mm thick scratch-coat of render should first be applied** using a trowel to even out the absorbency of the substrate and to improve adhesion of the coating material. During the application of the scratch-coat, appropriate pressure should be applied to the fresh mixture to get the mortar into all crevices and ensure adequate adhesion is achieved.

- The scratch-coat shall be allowed to set before proceeding with the application of subsequent layers. The curing methods hereby specified should be adopted to ensure that the performance of the hardened material is appropriate.
- If considered necessary, the surface of the scratch-coat may be scratched to provide a key for the next layer of mortar.

(iii) After setting of the scratch-coat layer starts, the **coating can be applied in several layers up to 20 mm thick**, until a uniform layer protruding by approximately 20 mm from the highest point of the stonework is achieved.

- The layers of the rending mortar on top of the scratch-coat can be laid using either a trowel or a continuous-feed rendering machine. In the latter case, the mortar should be applied from a distance of approximately 20 cm so that it is laid evenly.

(iv) The positioning of the mesh should be such that this reinforcement layer would lie approximately at the mid-thickness of the finished render coating. Hence, **after applying the mid render layer, and while the mortar is still fresh, the mesh shall be placed all over the surface** and pressed down lightly with a flat trowel so that it adheres to the mortar and is positioned correctly against the fasteners/connectors applied previously.

- Adjacent pieces of mesh fabric should overall by least 40 cm, both lengthways and widthways.

(v) Before the addition of any subsequent layer of mortar the underlying surface should be dampened. Each layer must be applied without tamping the previous layer.

- A few minutes after the application of a mortar layer, its surface should be leveled off by using an aluminum H-type or blade-type straight edge or other approved levelling component. The latter should be passed over the surface horizontally and vertically until it is flat.

(vi) Vertical shims or other guiding installation which were previously attached to the wall should be removed after the desired coating thickness is achieved and the **gaps shall be filled with the same mortar**. The surface of the **final coating layer must be finished off a few hours after its application using a plastic, wooden or sponge float**.

- The area shall be worked over with the float until adequate smoothness is achieved.

(vii) Any mortar spilled on adjacent historic fabric during the works must be cleaned as soon as practicable, and preferably before it hardens.

2.2.17.3.3 Application of waterproofing compound

Mixing of the waterproofing compounds shall be carried out using suitable mechanical equipment. Mixing by hand is **not** permitted.

The mixing apparatus used and the mixing times and rates shall depend on the instructions given by the supplier of the material and shall be such that a homogenous mixture free of lumps is formed. The material must be used before its workable life has expired. An indicative value of the maximum working life of cement-free polymer lime-based waterproofing materials is 60 min. Mixing of and application of such waterproofing materials in excessively cold ($T < 5^oC$) or hot ($T > 35^oC$) weather conditions should be avoided as this can affect workability and end-performance.

Waterproofing works shall commence only after the rendering layer has completed cured (typically 7 days per 1 cm of render mortar thickness).

The waterproofing material shall be applied on a clean surface free from any traces of grease, dust release agents and any other material which could reduce adhesion.

Prior to the application of the waterproofing material the finished render **substrate must be thoroughly cleaned with low pressure water**. The **waterproofing coating shall be applied on at least 2 layers** using one of the methods specified below:

- **Manual application**: This method can be applied provided that it is specified by the manufacturer of the selected product. Depending on the specifications of the selected product, the coating may be applied with a brush, roller or spreader to form a layer at least 2 mm thick. After the first layer is perfectly dry (indicative time > 6 hours) a second layer of coating again > 2mm thick shall be applied. Between successive layers the material must be applied along in 2 diagonally opposite directions (i.e. cross-wise).
- **Application by spraying**: This method can be applied provided that it is specified by the manufacturer of the selected product. Depending on the specifications of the selected product, the coating may be applied using a rendering machine equipped with a finishing lance and a spray nozzle of appropriate diameter. The final thickness of each application layer must always be at least 2 mm. Successive coating layers can be applied after the previous layer layer is perfectly dry (indicative time > 6 hours).

Regardless of the application method, the **end-surface of the waterproofing layer shall be finished off** before setting of the material initiates **using a slightly moist sponge float** to form an even finish.

2.2.17.3.4 Protection and curing

Adequate time must be left between the applications of subsequent render layers to ensure sufficient setting of the mortar. Indicatively, it is noted that, on average, this can take a minimum of two weeks, depending on the mortar mix used and time of year.

As a rough guide for checking whether setting is appropriate, it is specified that each coat should be hard enough to resist indentation from a knuckle, but soft enough to scratch with a fingernail. Proper curing should be implemented to ensure adequate performance of the coating materials.

New coating layers must be protected from drying out too quickly and against heavy rain and frost. This may be achieved by the **covering of surfaces with hessian fabric (i.e burlap) or plastic membranes**. Moisture shall be kept in the mortar mixture for at least 72 hours (or for a period equal to the curing period stated by the supplier of the mortar), before being allowed to dry out slowly. For this purpose, in addition to covering with fabrics/membranes, **regular spraying with water** should be applied. Plastering/rendering **works on exposed exterior spaces should be stopped during periods of heavy rain** and the coated masonry sections should be protected.

Waterproofing coats must be protected with polyethylene sheets for at least 24 hours after application to prevent washing away of the material from rain or accidental spills and to stop rapid evaporation.

All coated surfaces should be protected from mechanical damage and disturbance taking into account other works in progress, subsequent construction operations and the use of scaffolding or of supporting installations at the areas near the repair.

2.2.18 [S20] REPAIR OF RENDER/ PLASTER MASONRY COATINGS

2.2.18.1 Scope and application

The technical specifications hereby given cover:

(i) The **repair of existing plasters/renders by patching missing areas or by replacing areas that exhibit extending deterioration** and/or incorporate crumbling sections of coating.
(ii) The **re-coating of surfaces after the removal of existing renders/plasters to facilitate repair interventions** such as grout injections and reconstruction of damaged masonry.

The repair and restoration of coatings aims at protecting masonry surfaces from weathering and at decelerating the deterioration and decay of the masonry materials.

The areas of the Monastic complex where works involving the application of new coating materials should be undertaken are indicated in the drawings of the tender documents. It is noted that the aforementioned drawings refer to the condition of the structure as it is in the time of this study.

Prior to the initiation of intervention works additional inspections should be carried out to verify that the proposed works are still appropriate for the areas indicated and to identify whether additional works may be required in other parts of the structures.

2.2.18.2 Materials

2.2.18.2.1 Rendering/plastering mortar

The mortar material used for the repair and restoration of masonry coatings should be a general-purpose mortar for internal/external render based on Natural Hydraulic Lime and free from cement.

The **color and texture of the mortar must be compatible with those of the mortars observed** on the masonry structures of the monument.

The material should satisfy the requirements set in EN 998-1 for rendering and plastering mortars of Category CS II (i.e. compressive strength at 28 days ≥ 1.5 MPa) and should possess a water vapor permeability of μ < 20 in accordance to EN 1015-19. The mortar can be of the commercial type **'*Mape-Antique Intonaco NHL*'** or **'*Kimia Tectoria PMP*'** or **'*Kimia Limepor MT*'**.

The use of other commercially available **products with equivalent characteristics** is permitted.

If a commercially available pre-blended product is to be used, prior to the initiation of works, the Contractor must provide samples of the intended mortar material **subject to approval by the supervising Architect and Civil Engineer**. In case a commercial mortar is selected, the application instructions of the manufacturer should be followed in detail.

The **use of purposely designed mortar mixtures is also permitted**. Such mixtures should be made from Natural Hydraulic Lime of grade NHL3.5 or NHL5 mixed with natural sand aggregates of grading 0-4 mm. The binder material can be of the commercial type **'*Limepor NHL3.5*'** or '***Lafarge NHL3.5'*** or **'*Saint-Astier NHL5*'** or **'*SECIL NHL5'*** and should satisfy the specifications set in EN 459-1.

The use of other **products with equivalent characteristics** is permitted, subject to approval by the supervising Architect and Civil Engineer.

The aggregates used for the composition of the mortar should be sharp sand, clean and well graded, free of clay, silt and organic matter. The use of local calcareous sand aggregate is recommended. The recommended proportions of the **mortar mixture are (lime: sand) 1:2 to 1:3 vol./vol**. In case a purposely designed mortar mixture is used, prior to the initiation of works, the **Contractor should prepare trial mixes and perform standardized laboratory tests** as per EN 1015-11 and EN 1015-19 in order to prove that the proposed material has a compressive strength at 28 days ≥ 1.5 MPa and a water vapor permeability of μ < 20.

2.2.18.2.2 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

Binder materials and/or pre-blended mortars delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost.

Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.

2.2.18.3 Methodology

2.2.18.3.1 Preparatory actions

New renders/plaster material should be applied after adequate preparation of the masonry surface on a clean, sound and compact substrate.

Preparatory works should include **manual removal of deteriorated/crumbling material portions** and **thorough cleaning of the surface** (i.e. low-pressure hydro-cleaning and/or cleaning with pressurized air can be applied) to remove dust, dirt, mildew or soluble salts.

Any loose/crumpling parts of existing plasters/renders at the vicinity of the area that will receive the new coating layer shall be removed manually by hacking off the old mortar back to a straight edge using a bolster chisel and a lump hammer.

The **edges of the existing coating surrounding the application area must be undercut to provide a key for the new render**, while the lower edge can be left square cut.

The joints of the stonework shall be raked out and any loose material shall be brushed away. Reference is hereby made to the specifications given for the removal of cementitious coatings for cases where the new mortar material is intended to be applied on surfaces currently covered by such renders/plasters (see paragraph 2.2.3.2.2).

The use of **bonding agents that are compatible with the repair materials can also be considered for achieving sufficient adhesion** between the existing and the new plaster. In such a case the Contractor must provide samples and specifications for the selected bonding agents subject to approval by the supervising Architect and Civil Engineer.

The **placement of vertical shims or other installations to guide the application of the coating materials** is permitted. This is particularly recommended in cases where large surfaces need to be plastered/ rendered.

In areas where coating applications are carried close to historic floors any other special elements of the Monastery, these surfaces must be covered using appropriate protective layers.

2.2.18.3.2 Execution of works

Mixing of the plastering/rendering mortar shall be carried out using a suitable mechanical mixer.

- The mixing time shall depend on the instructions given by the supplier of the binder material or of the pre-blended mortar composition and shall be such that sufficient workability is attained without segregation (recommended mixing time 3-5 min).

Mortar must be used before its workable life has expired. An indicative value of the maximum working life for lime renders is 45-60 min. Any mortar left after the initial set has commenced should be discarded and should not be reconstituted. Mixing of mortar in excessively cold ($T < 4^oC$) or hot ($T > 38^oC$) weather conditions should be avoided as this can affected the workability and end-performance of the capping material.

Following the preparation of the substrate, the **area of application should be saturated** to prevent the masonry materials drawing water from the plaster/render, thus compromising its final performance characteristics.

- Any excess water after wetting of the substrate must be left to evaporate so that the masonry is saturated and the surface is dry.
- Compressed air may be used to speed up this process. The application of plastering/rendering mortar should always start from the lower part of the section to be coated and continue by working upwards.

A **5 mm thick scratch-coat of plaster/render should first be applied** using a trowel to even out the absorbency of the substrate and to improve adhesion of the coating material.

- During the application of the scratch-coat, appropriate pressure should be applied to the fresh mixture to get the mortar into all crevices and ensure adequate adhesion is achieved.
- The scratch-coat shall be allowed to set before proceeding with the application of subsequent layers.

- The curing methods hereby specified should be adopted to ensure that the performance of the hardened material is appropriate.
- If considered necessary, the surface of the scratch-coat may be scratched to provide a key for the next layer of mortar.

After setting of the scratch-coat layer starts, the **coating can be applied in several layers up to 30 mm thick**, depending on the depth of the original coating being repaired or the intended end-thickness of the new coating.

Layers of plastering/rending mortar on top of the scratch-coat can be laid using either a trowel or a continuous-feed rendering machine. In the latter case, the mortar should be applied from a distance of approximately 20 cm so that it is laid evenly.

Before the addition of any subsequent layer of mortar the underlying surface should be dampened. Each layer must be applied without tamping the previous layer.

A few minutes after the application of a mortar layer, its surface should be leveled off by using an aluminum H-type or blade-type straight edge or other approved levelling component.

- The latter should be passed over the surface horizontally and vertically until it is flat.

Vertical shims or other guiding installation which were previously attached to the wall should be removed after the desired coating thickness is achieved and the **gaps shall be filled with the same mortar**.

The surface of the **final coating layer must be finished off a few hours after its application using a plastic, wooden or sponge float**. The area shall be worked over with the float until adequate smoothness that resembles the texture of the existing coatings is achieved.

Any mortar spilled on the historic fabric during the works must be cleaned as soon as practicable, and preferably before it hardens.

Prior to the initiation of coating applications, the **Contractor must prepare a sample area of 1.5 m^2** approximate size that should be inspected and be subject to approval by the supervising Architect and Civil Engineer.

Coating application can commence only after the sample has been accepted and the contractor has identified and marked all areas where relevant works shall be implemented and these are agreed with the supervising Architect and Civil Engineer.

2.2.18.3.3 Protection and curing

Adequate time must be left between the application of subsequent plaster/render layers to ensure sufficient setting of the mortar.

- Indicatively, it is noted that, on average, this can take a minimum of two weeks, depending on the mortar mix used and time of year.
- As a rough guide for checking whether setting is appropriate, it is specified that each coat should be hard enough to resist indentation from a knuckle, but soft enough to scratch with a fingernail.

Proper curing should be implemented to ensure adequate performance of the coating materials.

New coating layers must be protected from drying out too quickly and against heavy rain and frost. This may be achieved by the **covering of surfaces with hessian fabric (i.e burlap) or plastic membranes**.

Moisture shall be kept in the mortar mixture for at least 72 hours (or for a period equal to the curing period stated by the supplier of the mortar), before being allowed to dry out slowly. For this purpose, in addition to covering with fabrics/membranes, **regular spraying with water** should be applied.

Plastering/rendering **works on exposed exterior spaces should be stopped during periods of heavy rain** and the coated masonry sections should be protected.

Coating surfaces should be protected from mechanical damage and disturbance taking into account other works in progress, subsequent construction operations and the use of scaffolding or of supporting installations at the areas near the repair.

2.2.19 [S21] REPAIR AND WATERPROOFING OF CEMENTITIOUS ROOF COATING

2.2.19.1 Scope and application

The works hereby described address the **repair and waterproofing of the cementitious coating covering of vaulted roofs**.

The exterior surface of the roof covering material exhibits cracking which needs to be repaired in order to prevent water seepage.

In addition to the repair of existing cracks, treatment with a suitable waterproofing compound should be carried out to ensure adequate protection against moisture ingress. The area of application is indicated in the drawings of the tender documents.

2.2.19.2 Materials

2.2.19.2.1 Crack injection material

The material used for the repair of cracks on the cementitious coating shall be a low viscous, epoxy or polyurethane injection resin capable of penetrating and sealing hairline and larger cracks (crack mouth opening > 0.2 mm). The material shall meet the minimum requirements set in EN 1504-5 for concrete injection materials.
The material can be of the commercial type **'*Mapei Epojet LV*'** or **'*Sika Injection-201 CE*'**. The use of **other commercially available products with equivalent characteristics** is permitted.

In case a material other than those specified here will be used, the contractor must provide specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.19.2.2 Crack sealing material

The injection of the crack repair materials herby specified typically requires the application of a material for the patching and sealing of the working surface. The selection of this material shall depend on the specifications of the injection resin that will be used.

It is noted that the injection resins hereby specified are compatible with adhesive fillers of the commercial type **'*Adesilex PG1*'** and **'*Adesilex PG2*'** and **'*Sika Injection-490*'**.

The use of **other commercially available products with equivalent characteristics** is permitted.

In case a material other than those specified here will be used, the contractor must provide specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.19.2.3 Material for the repair of missing sections and/or voids

In case at the time of the repairs, missing sections and/or relatively large voids (> 4 cm) are detected on the roof covering, these should be repaired using a suitable cement mortar mixture.

The use of a rapid hardening repair mortar with extended working time is recommended. This can be of the commercial type **'*Planitop 18 ES*'**. The use of **other commercially available products with equivalent characteristics** is permitted, **subject to approval by the supervising Architect and Civil Engineer**.

A **general purpose prescribed mortar mixture** composed of cement binder of class CEM 32.5 or superior and well graded sand, clean of clay, silt and organic matter may also be considered appropriate, subject to approval from the supervising Civil Engineer at the time of the works. Such a mortar mixture can be prepared on site by mechanically mixing the constituents at a **ratio (cement: sand) of 1:2 to 1:3 vol./vol**.

2.2.19.2.4 Waterproofing material

The waterproofing material that shall be applied on the surface of the repaired roof coating shall be a sufficiently flexible cementitious mortar suitable for the waterproofing of existing coverings subject to flexural strain.

The material should also be suitable for mechanical application by spraying or for manual application by brush or trowel. The material can be of the commercial type **'*Mapelastic*'** or **'*Sikalastic-1K*'**. The use of **other commercially available products with equivalent characteristics** is permitted.

In case a material other than those specified here will be used, the contractor must provide specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.19.2.5 Mesh reinforcement for waterproofing coating

To prevent the formation of cracks, the waterproofing coating material shall be reinforced with an alkali-resistant mesh composed of glass fibers and certified in accordance to ETAG 004. The mesh can be of the commercial type **'*Mapenet 150*'** or **'*Masternet A-160*'**.
The use of other commercially available **products with equivalent characteristics** is permitted.

In case a material other than those specified here will be used, the contractor must provide samples and specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.19.2.6 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose.

Crack repair and waterproofing materials must be kept in their original packaging in cool and dry conditions, under roofed spaces protected from water.

Glass fiber meshes should be stored in a clean and dry place without being exposed to UV radiation.

Binder materials and/or pre-blended mortars delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost.

Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.

2.2.19.3 Methodology

2.2.19.3.1 Repair of cracks on the exterior surface of the roof covering layer

Mixing of resin-based crack filling materials, adhesive fillers and mortars shall be carried out using suitable mechanical equipment.

- Mixing by hand is permitted only for resin-based injection materials, provided that this is specified by the manufacturer of the product.

The mixing dosages, as well as the mixing apparatuses used and the mixing times and rates shall depend on the instructions given by the supplier of each material and shall be such that homogenous mixtures are formed.

All materials must be used before their workable life has expired.

- An indicative value of the maximum working life for resin-based injection materials and adhesive fillers is 35 min.
- It is noted that mixing and application of most commercially available resin-based materials is subject to temperature constrains. Typically such materials must be used in temperatures between 5^{o}C and 25^{o}C to ensure applicability and adequate end-performance.

To prepare the substrate for the execution of the repair works, all **crumbling or detached portions of material and all traces of cement laitance should be removed by brushing**.

Any **missing sections and/or relatively large voids (> 4 cm) detected on the roof covering at the time of the works should be completely filled and restored** by means of the specified mortar material.
Prior to the initiation of crack injection works, all cracks on the exterior surface of the roof covering must be identified and marked by the contractor.

The marked cracks should be inspected by the supervising Civil Engineer, who must provide his/her consent for proceeding with the treatment of these areas.

Cracks that are less than 0.5 mm wide should be opened.

A series of **holes approximately 8-9 mm in diameter shall be drilled along the length of the crack at intervals of about 50-80 mm** to accommodate the **installation of packers** though which the repair resin will be injected.

The **entire working surface shall then be patched and fully sealed using the adhesive filler** hereby specified.

If the holes cannot be formed for any reason (e.g. because of lack of space), flat head injection tubes may be inserted directly onto the cracks and fixed on the surface with the adhesive filler.

In any case, both the perimeter of the injector fitting and the crack must fully covered by the adhesive filler. After the sealing material has hardened (typically ≥ 12 hours) compressed air should be injected to make sure that the injection system is completely free.

Unless the manufacturer of the selected resin-based crack repair material specifies that the product can be applied by pouring or otherwise, application shall be carried out using a suitable pump. The injection process shall always start from the point located at the lowest elevation of the vaulted surface.

The **material shall be injected until the resin overflows out of the next packer/tube**. When overflow occurs, the packer/tube being injected will be closed and the procedure shall continue moving upwards to the closest packer/tube.

- This shall be repeated until all packers/tubes are injected and the entire crack is completely filled.
- Then the **packers/tubes may be removed and the holes can be filled with the same adhesive filler** used for sealing the crack mouth.

2.2.19.3.2 Waterproofing of the repaired roof covering layer

Mixing of cementitious waterproofing materials shall be carried out using suitable mechanical equipment.

Mixing by hand is not permitted.

The mixing apparatus used and the mixing times and rates shall depend on the instructions given by the supplier of the material and shall be such that a homogenous mixture free of lumps is formed.

The material must be used before its workable life has expired.

- An indicative value of the maximum working life of cementitious waterproofing materials is 30 min.
- Mixing of cementitious waterproofing materials in excessively cold ($T < 4^oC$) or hot ($T > 38^oC$) weather conditions should be avoided as this can affect workability and end-performance.

Waterproofing works shall commence only after the repair of the covering layer has been completed and this work has been inspected and approved by the supervising Architect and Civil Engineer.

In addition, sufficient time for the complete hardening of the repair materials applied on the surface of the covering should be allowed.

The waterproofing material shall be applied on a clean surface free from any traces of grease, release agents, cement laitance and any other material which could reduce adhesion.

Prior to the application of the waterproofing material the **substrate must be adequately dampened**, avoiding however any ponding on the surfaces. The waterproofing coating shall be constructed using one of the methods specified below:

- **Manual application by trowel (preferable method)**: The prepared surface shall be skimmed with a very thin layer of the waterproofing material using a smooth trowel. While the first coat

is still fresh a second coat shall be applied to achieve a thickness of at least 2 mm. On the surface of the fresh layer apply the reinforcing mesh, by pressing it gently with the trowel so that it is fully embedded in the waterproofing material. Successive pieces of glass fiber mesh should overlap by at least 5 to 10 cm. When the initial layer dries (typically > 4 hours), a final coat shall be applied to achieve a finished coating thickness of about 4 mm. During application with a trowel the pressure exerted onto the treated surface shall be maintained as even as practically possible to ensure uniform laying of the waterproofing material.

- **Manual application by brush**: This method can be applied provided that it is specified by the manufacturer of the selected product. Application by brush must be undertaken with the maximum attention to uniformly covering the whole surface. The maximum allowable thickness of each layer applied by brush is 1 mm. The application of at least 3 layers is required. Between successive layers the material must be applied along in 2 diagonally opposite directions (i.e. cross-wise). After the application of the first layer, and while the material is still fresh, apply the reinforcing mesh, by pressing it gently with the trowel so that it is fully embedded in the waterproofing material. Successive pieces of glass fiber mesh should overlap by at least 5 to 10 cm. Successive coats must only be applied when the previous one is dry (typically > 4 hours).
- **Application by spray gun**: This method can be applied provided that it is specified by the manufacturer of the selected product. The material can be applied in successive layers using a spray gun with a lance fitting suitable for use with smoothing mortars. The minimum thickness of each layer shall be 2 mm. The application of at least 2 layers is required. After the application of the first layer, and while the material is still fresh, apply the reinforcing mesh, by pressing it gently with the trowel so that it is fully embedded in the waterproofing material. Successive pieces of glass fiber mesh should overlap by at least 5 to 10 cm. Successive coats must only be applied when the previous one is dry (typically > 4 hours).

The waterproofing coats must be protected from rain for at least 48 hours after the completion of their application.

Finishing of the coating can be carried out only after complete hardening of the waterproofing material. This can be implemented by **removing any roughness by means of light sanding**. The use of blast cleaning or of abrasive methods other than sanding in order to finish the final surface is not permitted.

2.2.20 [S22] CONSOLIDATION OF HISTORIC FLOORS

2.2.20.1 <u>Chapel and Narthex Flooring Tiles</u>

The restoration of the historic floor includes cleaning of the tiles which are in a good condition, while the areas in which the tiles are destroyed will be replaced with similar decorated tiles. The new tiles' colour will be a tone lighter than the one of the original tiles, in order to distinguish the old ones with the new ones.

- Colour samples to be submitted by the Contractor for final approval.

The consolidation of historic floors is indicated at the drawings of the tender documents.

Cleaning Process Details and Description:

1. Original tiles will initially be washed via clean water. Drinkable, free of substances capable of affecting plaster set or of damaging plaster, lath or accessories.

Cleanliness: Free from dirt, dust, efflorescence and mold, and other contaminants incompatible with tiling.

2. Each tile will be treated individually, manually by hand, repair and clean its individual cracks, colour filling and special cleaning treatment, according to its condition. Color filling is taking place with the use of a spacer and each colour that should be added is placed individually at once (for instance: 2 days for black, 3 days for red, e.t.c.). The exact methodology and the treatment of the tiles has to do with the specialized working team that is going to consolidate the historic floors.
3. As soon as all tiles will be treated individually, the floor as one entity will be rubbed. If any tiles are still imperfect after rubbing – corrections will be made. This procedure will be repeated 2-3 times until tiles are in a perfect, look alike condition and to reach specified flatness.
4. Joints between the tiles will later on be cleaned and filled where necessary. Dust and debris: Remove from joints.
5. The tiles will be left to dry for 2-3 days and then the surface protector will be applied on top. The surface protector will consists of no more than 20% of gloss liquid, for a light glossy effect. The surface protector must the same or equivalent to HG impregnating protector which contains silicone.
6. Furthermore, a self-polishing cleaner, same or equivalent to HG neutral cleaner, will be applied for 1-2 layers, to provide the most clean, shiny and yet protected for the colored tiles, version possible.

All materials used will include no acid chemicals within.

Thin-set Portland Cement Mortar: Where thin-set Portland cement mortar applications are indicated, use the following unless otherwise recommended by manufacturer or required by the Engineer:

1. Latex-Portland cement mortar.
2. Epoxy mortar
3. Organic adhesive

Tile Cleaner: Product specifically acceptable to tile manufacturer and grout manufacturer for application indicated.

Cyprus Standards:
Source of Materials: Provide materials obtained from one source acceptable to the Engineer for each type and colour of tile, grout and setting materials.
Implementation Process Details and Description:
Subfloor Preparation: In order to start the implementation of the tiles, we clean up the area from any kind of dirt and dust and we brush the floor two times by using a specialized admixture primer the same or equivalent to BIO ACRYL B13 of VIODOM in order to enhance the weak subfloor.

1. *Step 1*:
   Waterproofing: Cement based, same or equivalent to SEAL STEG SL42 mixed with BIO ACRYL B-13 of VIODOM, is applied by the use of brush in two crossed layers. The mixture is applied on the whole floor and few centimetres across the wall base.
2. *Step 2*:
   A water repellent sealing cloth is used for the floor to wall connection, same or equivalent to, the DURABASE WP25 of DURAL. For the application, a thin layer of glue same or equivalent to SUPER MARMOGRAN SP-25 of VIODOM is applied.
3. *Step 3:*

Glue, same or equivalent to SUPER MARMOGRAN SP-25, is applied on the subfloor and at the back of each tile. After the application, the joints and the levelling are taken care of.

4. Step 4:
   The tiles are coated with,same or equivalent to, PROTECT IM by PATINA FALA in order to give the opportunity to the tiles to be able to be easy get cleaned after the application.
5. Step 5:
   Filling of the joints with joint-stucco, same or equivalent to GRANITO FS-4 by VIODOM
6. Step 6:
   In case there is a baseboard, it should be applied in a way that doesn't have direct connection to the floor tiles. It should be placed slightly higher and sealed with silicone S70 of desired color.
7. Step 7:
   The upper part of the baseboard is enclosed with, same or equivalent to, mastic silicone A215 by Ottochemie which can be painted.
8. After application, the floor is cleaned with, same or equivalent to, PATINA FALA MR1 and a liquid same or equivalent to the protection liquid FLECK by PATINA FALA which offers long-lasting protection from stains and waterproofs.

2.2.21 [S23] STEEL ENCLOSURES

2.2.21.1 Restoration of Metal Frame Windows

- Existing metal window and metal guard to be cleaned and painted in color matching the existing color used in-situ over anti-rust primer.
- A new laminated (3mm+3mm) clear glass with lamination membrane is to be installed within the existing metal frame utilizing putty.
- Measurements should be taken on site before cutting glass.

The proposed windows are illustrated in the drawings of the tender documents.

2.2.21.2 Metal Frames:

All metal frames for doors, windows and other openings, of size and profile as indicated in the drawings of the tender documents.

- All metal frames to receive mortised and concealed finish ironmongery, including cut-outs, reinforcing, drilling and tapping in accordance with final Door and Ironmongery Schedules and templates provided by ironmongery supplier. Provide cover bases at the back of all hardware cut outs.
- All metal frames to receive surface-applied ironmongery. Drilling and tapping for surface-applied door/window ironmongery may be done at project site.

2.2.21.3 Primary Glass Standard

Provide primary glass which complies with specific referenced standard requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.

Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer.

Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), and Quality q3 (glazing select), to BS 952: Section I: Part 3.

Wired Glass: Type II (patterned and wired glass, flat), Class 1 (translucent), Quality q8 (glazing): complying with resistance requirements: 6 mm thick: of form and mesh pattern indicated below: Polished Wire Glass: Form 1 (wired, polished both sides), Mesh m2 (square).

2.2.21.4 Galvanized Metal Barrier - West, North, South Entrance

The proposed fixed gate installed at the west, north and south entrance will be comprised of welded galvanized tubes, in a way that allows visual observation, while at the same time restricting physical access. The tubes will be bolted onto 3 number of tube clamps that are screwed onto concrete substrate. The proposed metal barrier is illustrated in the drawings of the tender documents.

2.2.21.5 For all metal work

Metalwork which will be exposed to view, the use of materials which are smooth and free of surface blemishes and including pitting, seam marks, roller marks, rolled trade names and roughness will be used. Fasteners are generally of the same metal as the component, with matching coating and finish.

Steel long and flat products:
a. Hot rolled structural steels (excluding structural hollow sections and tubes): To CYS EN 10025-
b. Fine grain steels, including special steels: To CYS EN 10025-3 and -4.
c. Improved atmospheric corrosion resistance: To CYS EN 10025-5.

Steel plate, sheet and strip:
a. Plates and wide flats, high yield strength steel: To CYS EN 10025-6.

Hot rolled steel plate, sheet and strip:
a. Flat products, high yield strength for cold forming: To CYS EN 10149-1, -2 and -3.
b. Low carbon steel sheet and strip for cold forming: To CYS EN 10111.
c. Narrow strip, formable and general engineering purposes: To BS 1449-1.8 and BS 1449 1.14.

Cold rolled steel plate, sheet and strip:
a. Steel sections: To CYS EN 10162.
b. Flat products, high yield strength micro-alloyed steels for cold forming: To CYS EN 10268.
c. Low carbon steel flat products for cold forming: To CYS EN 10130 and CYS EN 10131.
d. Uncoated mild steel narrow strip for cold forming: To CYS EN 10139 and CYS E 10140.
e. Narrow strip, general engineering purposes: To CYS EN 10132-1, -2, and -3.
f. Low carbon steel flat products for vitreous enamelling: To CYS EN 10209.

Steel coated flat products:
a. Hot dip zinc coated low carbon steel sheet and strip for cold forming: To CYS EN 10327 and CYS EN 10143.
b. Hot dip zinc coated structural steel sheet and strip: To CYS EN 10143 and CYS EN 10326.
c. Hot dip zinc-aluminium (za) coated sheet and strip: To CYS EN 10326 and 10327.
d. Hot dip aluminium-zinc (az) coated sheet and strip: To CYS EN 10327.
e. Organic coated flat products: To CYS EN 10169-1.

Steel structural hollow sections (SHS)
a. Non alloy and fine grain steels, hot finished: To CYS EN 10210-1 and -2.

b. Non-alloy and fine grain steels, cold formed welded: To CYS EN 10219-2.
c. Weather resistant steels, hot finished: To BS 7668.

Other steel sections:
a. Equal flange tees: To CYS EN 10055.
b. Equal and unequal angles: To CYS EN 10056-1 and -2.
c. Wire, mild steel for general engineering purposes: To BS 1052.
d. Wire and wire products, general: To CYS EN 10218-2.
e. Tubes:

- Cold finished electric resistance welded: To BS 6323-6.
- Cold finished seamless: To BS 6323-4.
- Seamless and welded generally: To BS 6323-1.
- Seamless circular: To CYS EN 10297-1.
- Seamless cold drawn: To CYS EN 10305-1.
- Welded and cold sized square and rectangular: To CYS EN 10305-5.
- Welded circular: To CYS EN 10296-1.
- Welded cold drawn: To CYS EN 10305-2.
- Welded cold sized: To CYS EN 10305-3.

Grey iron Castings: To CYS EN 1561.
Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
Concrete inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron or cast steel. Provide bolts, washers and shims as required, hot-dip galvanized.

2.2.21.6 Fasteners

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.
2. Bolts and Nuts: Regular-hexagon head type.
3. Lag Bolts: Square head type.
4. Machine Screws: Cadmium plated steel.
5. Wood Screws: Flat head carbon steel.
6. Plain Washers: Round, carbon steel.
7. Anchorage Devices: Drilled in expansion anchor bolts.
8. Toggle Bolts: Tumble-wing type, class and style as required.
9. Lock Washers: Helical spring type carbon steel.

2.2.21.7 Paint and other finishes

New shop-made structural steel members shall have a protective paint system consisting of (a) a primer coat, (b) an undercoat and (c) a topcoat.
The following commercially available products can be used:

(a) Primer coat:

- Hempadur AvantGuard 750 or
- Galvosil 15700

(b) Undercoat:

- Hempadur Mastic 45880

(c) Topcoat:

- HEMPAXANE LIGHT 55030 (for high gloss finish) or
- Hempathane HS 55610 (for gloss finish) or
- HEMPATHANE HS 55613 (for semi-gloss finish)

The use of other commercially available **products with equivalent characteristics** is permitted.

In case a material other than those specified here will be used, the contractor must provide samples and specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

For **existing structures**, the surface must be prepared according to the specifications of the selected treatment product (it is noted that most manufacturers specify dry blast-cleaning) and can then receive (a) a primer coat and (b) a topcoat.
The following commercially available products can be used:

(a) Primer coat:

- Hempadur Mastic 45880

(c) Topcoat:

- Hempadur Mastic 45880 (same as primer coat) or
- Hempathane TL87

The use of other commercially available **products with equivalent characteristics** is permitted.

In case a material other than those specified here will be used, the contractor must provide samples and specifications for the material **subject to approval by the supervising Architect and Civil Engineer**. In all cases, the application instructions of the manufacturer should be followed in detail.

2.2.22 [S24] TIMBER ENCLOSURES

2.2.22.1 Timber Doors

The doors will be constructed of Swedish pine wood that shall either be pre-impregnated (preferable) or shall be treated with a suitable preservative. Acceptable timber species include Whitewood & Spruce (Picea Abies) and Pine (Pinus sylvestris). The supplied or treated softwood that will be selected must satisfy the requirements of EN351 and EN599.

Door will sit on butt hinges and receive trimming all around. The door will have a traditional Cyprus style metal lock and handle set that will be painted with transparent wood vanish. The proposed doors are indicated in the drawings of the tender documents.

Installation of Door Guidance:

- Examine door and window frames and verify that frames are correct size and type and have been installed as required for proper hanging of corresponding doors. Do not proceed with installation until unsatisfactory conditions have been corrected.
- Timing

After associated rooms have been made weathertight and the work of wet trades is finished and dried out.

- Installing Frames

Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

- Door Installation

Fit hollow metal steel doors accurately in their respective frames, within the following clearances:

Jambs and head: 3mm.

Meeting edges, pair of doors: 3mm.

Bottom, the undercut height to be as indicated on the shop drawings.

Refer to finish ironmongery as indicated on the shop drawings or ironmongery schedule for finish ironmongery installation.

2.2.22.2 Restoration of the timber windows

Timber window frame with fixed glass is to be overhauled and painted to match existing color of the monastery.

Existing timber glazing beads are to be taken out for glass installation. Broken beads will be replaced to match size of the existing.

A new laminated (3mm+3mm) clear glass with lamination membrane is to be installed within the existing timber frame. Site measurements to be taken before cutting glass.

The proposed windows are illustrated in the drawings of the tender documents.

2.2.22.3 OSB Oriented Strand Board

2.2.22.3.1 Timber partitioning for blocking access

Timber partitioning frame is to be formed of 5cmx5cm pine wood that is to be screwed onto existing timber frame using brackets.

All wood to receive one coat of wood preservative and two coats of wood topcoat (see paragraph 2.2.5.2.1 & 2.2.5.2.2).

The proposed timber partitioning are illustrated in the drawings of the tender documents.

2.2.22.4 Scope and application

The main OSB standard is: EN 300: Oriented Strand Boards (OSB) – Definitions, classification and specifications. However, all OSB products used in European construction must comply with the overall standard for wood-based panels, EN 13986: 2004+A1 2015.

The intended positions of the OSB to be installed are indicated in the architectural drawings to block specific openings in Block A. Their exact positions and layout shall be indicated on site by the supervising Architect.

Guidance on the use of OSB in these load-bearing applications is given in ENV 12872 and EN 13986. OSB is a quality, precision-engineered product that can satisfy the same applications and loading conditions as plywood and in some cases a thinner OSB panel may be used thereby reducing costs.

2.2.22.5 Materials

OSB is readily identified by its relatively large and long wood strands. The orientation of the surface strands is not always visually apparent, especially in small cut pieces of panel. The main merits of

OSB lie in the field of its mechanical performance, which is directly related to the geometry of the strands and their orientation within the panel. Although OSB is made up of relatively large strands of wood, its surface is relatively smooth and this can be further enhanced by sanding without losing the aesthetic character which is unique to OSB.

OSB varies in colour from a light straw colour to a medium brown depending on wood species used, resin system adopted and pressing conditions employed. It contains no knotholes, core voids or points of weakness.

Four grades of OSB are defined in EN 300 in terms of their mechanical performance and relative resistance to moisture. These are:

OSB/1 - General purpose boards and boards for interior fitments (including furniture) for use in dry conditions.
OSB/2 - Load-bearing boards for use in dry conditions.
OSB/3 - Load-bearing boards for use in humid conditions
OSB/4 - Heavy-duty load-bearing boards for use in humid conditions.

2.2.22.6 Methodology

- The intended positions of the OSB to be installed are indicated in the architectural drawings to block specific openings in Block A.
- Their exact positions and layout shall be indicated on site by the supervising Architect.
- Measurements should be taken on site before cutting OSB.

2.2.22.7 Timber Selection Standards for all timber work:

Finishing:

a. Surfaces: Smooth, even and suitable to receive finishes.

b. Arises: Eased unless shown otherwise on drawings.

c. End grain in external components: Sealed with primer or sealer as section M60 and allowed to dry before assembly.

Fasteners and Anchorages:

Provide size, type, material and finish as indicated and as recommended by applicable standards, for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails. Where timber work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating.

2.2.23 [S25] REMOVAL OF EXISTING CONCRETE SECTIONS

2.2.23.1 Scope and application

The works hereby described refer to the **cutting and removal of existing reinforced concrete sections**.
The areas of where cutting and removal of existing reinforced concrete sections will take place are indicted in the drawings of the tender documents.

2.2.23.2 Methodology

2.2.23.2.1 Preparatory actions

Prior to the initiation of any works, the **Contractor must identify and mark the positions where cutting and removal of concrete sections will be undertaken**.

In addition the **Contractor must prepare and submit in advance a method statement clearly describing the intended course of action for the removal of the concrete balcony and for the support of the nearby structures**.

Works may commence only after this method statement has been approved by the supervising Architect and Civil Engineer.

2.2.23.2.2 Execution of works

In all cases **undisturbed concrete cutting** shall be implemented without using vibratory equipment or generating dust and without overloading the existing structure of the building.

Cuts shall be made **using diamond discs fitted on suitable cutting equipment**.

The use of high-pressure water jetting, wrecking balls or demolition hammers is **not** permitted.

Particular attention shall be placed on avoiding causing any damage to the historic fabric near the area of the cutting.

Following the removal of concrete sections **any damage recorded on the adjacent masonry structures must be repaired** as per the relevant specifications given.

2.2.24 [S26] GARDENING WORKS

2.2.24.1 Scope and application

Pruning of trees is necessary to reach an ideal and tidy look of the courtyard but safe for its users as well. Pruning involves the selective removal of certain parts of all plants and trees, but also branches, buds, or roots.

Reasons to prune the plants include:

(i) Deadwood removal.
(ii) Shaping of existing trees by controlling or redirecting its growth.
(iii) Improving or sustaining the trees health, reducing risk from falling branches.
(iv) Harvesting and increasing the yield or quality of all surrounding flowers.

The aforementioned works should be carried out throughout the Construction Site.

2.2.24.2 Methodology

(i) All **dead branches** found on site **shall be removed** and deposited in areas outside the Monastery building, but within the boundaries of the building plot, **to be transferred away for disposal**.

All **dead or dying branches injured by disease, severe insect infestation, animals, storms, or other adverse mechanical damage must be removed as well, along with branches that rub together and branch stubs**.

All **hazardous trees must be taken down.**

(ii) The second step includes **pruning of larger scale trees to improve appearance, reassure safety and control growth and size.**

- Firstly **pruning of weak or narrow-angled tree branches that overhang** the courtyard or the sidewalks and anyplace falling limbs could injure people or damage the monastery.
- **Prune branches that obscure vision to the monastery** in general and
- For security purposes, **prune shrubs or tree branches that obscure the entry to the chapel.**

It is highlighted that all above works **shall be done in the presence and under the supervision of a qualified Landscape Architect, the Architects and a Gardener** as hereby specified.

The Gardener shall **inspect all trees and flowers to be removed or pruned** from the courtyard space and shall **identify and record any actions to be taken prior of doing so**.

Appropriate documentation of the process should be kept. For this purpose, throughout the duration of the gardening works hereby specified, the Gardener must submit to both the Client and the supervising Architect and Engineer a **written report on a daily basis**. This report must include detailed information on the areas cleaned/trimmed/pruned, the materials/items used and details of the procedure which will be used to do so.

Regarding the latter, reference is made to the description given for the selection and use of herbicides in the technical specifications referring to the treatment of organic growths. Dead plants and cut out foliage shall be collected and disposed regularly throughout the cleaning process as well.

All **works shall be carried out manually and/or using hand-held equipment**. The use of excavators at the interior of the Monument is not permitted as this entails the danger of causing damage to the historic fabric, while the confined space at the access points of the building currently limits the use of such machinery.

2.2.25 [S27] MAINTENANCE OF DRAINAGE SYSTEMS

2.2.25.1 Scope and application

The works hereby described refer to the **cleaning and maintenance of existing drainage systems**. Such systems exist at the:

- Courtyard of the monastery
- Roof of Block B.

Their positions are indicated in the drawings of the tender documents.

2.2.25.2 Courtyard Drainage System

2.2.25.2.1 Preparatory actions

The **Contractor must identify and map all existing drainage systems** prior to proceeding with any works for their maintenance.

Before the inspection and cleaning of the drainage elements themselves, any **mud or vegetation at the vicinity of inlets, outers or chambers/manholes which are likely to impede the flow of water must be removed**.

All **adjacent surfaces of the structures shall be protected** to prevent staining by arisings from the drainage cleaning operation.

2.2.25.2.2 Execution of works

The cleaning operation shall **ensure that all gullies, chambers and piped and channeled drainage elements are in proper operating condition and that all inlets and offlets are free from vegetation, debris, silt or other obstructions**.

At gullies and chambers, the cover or grating shall be removed and the element shall be cleansed of all water, detritus, debris and silt and then refilled with clean water to the outlet level.

Cleaning and testing of piped drainage systems and channels shall be carried out by rodding and low pressure high volume jetting. Initial attempts to clear blocked drains prior to jetting, shall be undertaken by hand rodding removing any debris and silt.

If the blockage cannot be removed by means of rodding, flashing shall be applied using suitable jetting equipment. The Contractor shall ensure that no damage occurs to manhole chambers or pipelines during insertion of the jetting equipment. Cleaning shall take place from downstream of the blockage in an upstream direction. The jetting head shall be propelled through or over the blockage and then the hose pulled backwards enabling the force of the jet to break up the blockage material. The application of pressure shall be regulated such that there is only sufficient to drive the jetting head across the silt to access remote from the point of entry.

The location of **any obstruction that cannot be removed by flushing shall be marked** on the ground using a wooden peg or other semi-permanent means and reported to the supervising Architect and Civil Engineer who may provide **instructions for alternative cleaning methods or for the replacement the blocked sections**.

All covers which have been removed for cleaning operations shall be placed back in position and shall be evenly bedded.

In case **covers are found to be damaged or exhibit rusting, these shall be replaced** by new covers of appropriate size approved by the supervising Architect and Civil Engineer.

2.2.25.3 Maintenance of the Roof of Block B

The works hereby specifically refer to the **replacement and re-installation of roof tiles of the Block B structure which are found to be damaged or loosely attached during the execution of works**.

2.2.25.3.1 Roof tiles

Clay (i.e. ceramic) roof tiles compatible with the existing ones shall be sued. The new clay tiles shall match the existing as closely as possible. Prior to the initiation of works, the **Contractor must provide samples and specifications** for the intended roof tiles subject to approval by the supervising Architect.

2.2.25.3.2 Mortar

Mortar for the laying of the roof tiles and for the filling of cut valley tiles **shall consist of 1 part portland cement (CEM 32.5R) to 3 parts damp plaster sand**, and shall be colored to the nearest possible match with the color of the tile. The use of pre-blended cementitious mortars is also accepted, subject to approval by the supervising Architect.

2.2.25.3.3 Storage of materials on site

The handling and storage of materials and products shall be such that these are not damaged or become unsuitable for their purpose. Clay roof tiles shall be stored in palettes and shall be protected from mechanical damage, frost and rain. Fillerized binders delivered packed in sealed sacks should be stored on palettes under roofed spaces and should be protected from moisture and frost. Aggregate materials delivered in bulk to the site should be kept on firm floor/ground to facilitate their handling and use.

2.2.25.4 Methodology

Appropriate equipment (such as padded ridge ladders) and techniques shall be used to prevent damage to roof as a result of foot or material traffic. The Contractor shall be responsible for controlling breakage of new or existing tile beyond what is indicated.

Prior to the initiation of works and after the removal of organic growths form the roof, the **Contractor shall examine the entire roof and verify each tile for tightness and damage.** The inspection should identify all missing and broken roof tiles, as well as any voids between tiles where seepage may occur. **Tiles which will be identified for replacement or re-installation and areas which need pointing shall be marked and documented** (photographically and schematically). The Contractor must submit this documentation to the supervising Architect for approval and to the supervising Quantity Surveyor for monitoring of works.

All loose and damaged roof tiles should be carefully removed along with the old mortar. Any parts of cracked or crumbling mortar should also be removed. Fixing of tiles without removing the old mortar is not recommended. **Removal of existing tiles and of bedding mortar shall be carried out manually** using suitable hand-held equipment (e.g. hammer and chisel). Prior to being installed, the **roof tiles shall be immersed in water**. The **tiles shall then be bed laid with mortar**. Existing reusable clay tiles removed from the repair area shall be intermingled with new clay tiles to provide a smooth visual transition between new and existing areas. All voids detected at the bedding mortar layer as well as at the ends of hips and ridges shall be filled with fresh mortar. After the hardening of the bedding mortar the repaired areas shall be repointed thoroughly using the same mortar mixture.

2.2.26 [S28] CONCRETE WORK

2.2.26.1 Scope and application

Unless otherwise stated, the provisions of **CYS EN 1992 Eurocode 2: Design of concrete structures** and **CYS EN 1998: Design of structures for earthquake resistance** shall be held to be incorporated in this Specification.

The work is to be carried out in accordance with drawings, sketches, specifications and instructions which are issued to the Contractor by the Engineer at the start and during the course of the Contract. The Contractor shall examine all details before commencing the work and in the case of a discrepancy, shall refer to the Engineer before proceeding.

The workmanship throughout the work shall be the best possible and to the satisfaction of the Engineer.

2.2.26.2 Materials

2.2.26.2.1 Aggregates

Aggregates for concrete shall consist of naturally occurring materials complying with the requirements of CYS EN 12620 and shall consist of sound, hard, clean, durable sand gravel or stone, whole or crushed or a combination thereof. They shall be of high crushing strength and free from adherent coatings such as clay, earth, vegetable and organic matter, alkaline or acid reactions, bituminous or any other deleterious matter or impurities.

They shall not contain harmful materials such as iron pyrites, coal, mica, shale or similar laminated materials, or flaky or elongated particles in such a form and in sufficient quantity to affect adversely the strength or durability of the concrete, or any materials which will cause expansion in the concrete after hardening has commenced or taken place or in addition to the above, for reinforced concrete, any materials which might attack the reinforcement.

They shall comply with the mechanical properties in CYS EN 12620 and in addition, the flakiness and elongation indices when determined by the method described in CYS EN 12620 shall not exceed 40 for 40mm aggregates nor shall it exceed 30 for 20 mm aggregates for concrete up to grade C25. For concrete of higher grade these indices shall be less than 25.

The amount of material passing a 0.075 mm BS sieve, wet analysis, shall not exceed 3% by weight of the natural fine aggregate, 5% by weight of the crushed fine aggregate and by 1% by weight of the coarse aggregate. Crushed fine aggregate shall be washed.

Sulphate content as S03 (Sulphur Trioxide): of both the fine and coarse aggregates shall not exceed 0.25% of the dry weight of the aggregate.

Chloride content: of the fine aggregates shall not exceed 0.10% by weight and of the coarse aggregate shall not exceed 0.05% by weight. However, if the above limit is exceeded, the material shall still be considered acceptable provided that:

Total acid soluble chlorides (as NaCl): in the whole mix shall not exceed 0.32% by weight of cement in the mix, irrespective of the origin of the chlorides.

Sulphates: in the aggregates shall not be more than double those present in the cement and the total acid soluble sulphates (as SO3) in the whole mix shall not exceed 4.0% by weight of cement.

The contractor shall submit to the Engineer for his approval, before taking over the work, samples of aggregates, details of sources of supply and details of the type of crushing and/or screening machinery he proposes to use. No aggregates are to be used until such approvals are been given by the Engineer.

2.2.26.2.1.1 Grading

The grading of coarse and fine aggregates when tested in accordance with CYS EN 12620 is to be within the limits defined in Tables 4 and 5 or to such gradings as the Engineer may require or deem necessary having regard to the availability of materials locally. The impact value of the coarse aggregate determined in accordance with CYS EN 12620 shall not exceed 23% by weight.

2.2.26.2.1.2 Soundness

When the coarse aggregate is subjected to five successive cycles of the sodium or magnesium sulphate soundness test, as described in the relevant method of test in ASTM-C88, the weighted loss

shall not exceed 12% or 18% respectively.

When the fine aggregate is subjected to five successive cycles of the sodium or magnesium sulphate soundness test, as described in the relevant method of test in ASTM-C88, the weighted loss shall not exceed 10% or 15% respectively.

2.2.26.2.2 Cement

No cement shall be used until the supply is approved by the Engineer and the approved source of supply shall not be changed without the written permission of the Engineer.

Portland cement is to be normal setting, of the specific gravity, fineness and chemical composition described in CYS EN 197-1 shall be capable of satisfying the tests specified therein.

Sulphate resisting cement shall conform to BS 4027 and shall be capable of satisfying the tests specified therein.

i. The tricalcium aluminate content of any cement shall not exceed 10.0%.
ii. The total alkali content, expressed as soda (NA_2O) shall not exceed 1.2%.
iii. The sulphuric anhydride (SO_3) content shall not exceed 2.5% when the C3A content is 5% or less. If the C3A content is greater than 5%, then the total SO_3 content shall not be greater than 3%.
iv. The specific surface (fineness) when determined by the method specified in CYS EN 197-1 shall be at least 225 m2/Kg.

The heat of hydration when determined by the method specified in BS 1370, shall not exceed 70 cals per gram when tested at 7 days nor exceed 80 cals per gram when tested at 28 days.

Certificates of cement tests by the manufacturers shall be submitted to the Engineer before he receives the work.

Cement bags shall be clean, sound and of adequate strength to permit handling and clearly marked with the name of the supplier and the type of cement contained therein in the manufacturer's bags unless they sign a written permission otherwise.

2.2.26.2.3 Reinforcement

Steel fabric reinforcement shall comply to the requirement of BS 4483 and shall be delivered to the site in flat mats.
Hot rolled mild steel bars and hot rolled deformed high yield bars shall comply with the requirements of BS 4449.

Where indicated by "R" on drawings and schedules, the reinforcement shall be mild steel bars with a minimum yield stress of S250 MPa.

Where indicated by "T" on drawings and schedules, the reinforcement shall be high yield steel bars with a minimum yield stress of 460 MPa to BS4449.

i. Uniform elongation at maximum load (charact. value) ($\varepsilon_{su,k}$) shall be ≥6%.
ii. The tensile strength to yield strength ratio (mean value of the ratio) (ft/fy) shall be between 1.15 and 1.35.

Plain and deformed steel wire shall comply with the requirements of BS 4482.

Tying wire shall either be:

i. 1.6 mm diameter soft annealed iron wire, or
ii. 1.2 mm diameter stainless steel wire

The source of reinforcement shall be approved by the Engineer, and the Contractor shall submit test certificates from an independent approved laboratory prior to proceeding with the work and reinforcement of all types and diameters must comply with the above-mentioned Standards to the satisfaction of the Engineer.

In order to use the reinforcement in the works, any test results should be satisfactory and any consignment of this tests should be removed from the site directed by the Engineer.

2.2.26.2.4 Water

Water used for mixing concrete and water for spraying aggregates and shutters, for curing and like purposes shall be clean and free from oil, grease, vegetable matter or other organic impurities.

The maximum content of dissolved chemical impurities shall not exceed two parts per thousand. When required by the Engineer, the quality of mixing water shall be determined in accordance with the requirements of CYS EN 1008.

In sampling water for testing, the containers must be clean and the samples should be representative. Public reticulation systems water for human consumption is accepted.

Prior to the commencement of concreting and subsequently once every three months, the Contractor shall sample and test the water supply for the presence of sulphate and chloride salts. The amount of dissolved solids in the water shall also be checked on a weekly basis by conductivity methods during the period when concrete work is being carried out, and any significant change in the amount of dissolved solids recorded shall be immediately investigated by further testing for sulphate and chloride salts.

If at any time when tested with universal indicator, the water supply has a PH value outside the limits of 5.5 to 8.5 then the Engineer shall be informed and the water shall be tested in accordance with the recommendations of CYS EN 1008 in order to determine the acceptability of the supply for further use. In the interpretation of the test results, the Engineer's decision shall be final.

2.2.26.2.5 Storage of Materials on Site

Aggregates shall not be stored in contact with the ground and shall be protected against the intrusion of the ground and other foreign matter. There shall be a physical partition between the stores heaps of fine and coarse aggregate and between separate heaped sizes of coarse aggregate which may have been segregated for mix control. Aggregates which in the opinion of the Engineer are not clean or which have become mixed due to defective storage shall be removed from the site immediately. Such permission will only be given in cases where the contractor has available on the site proper bins or silos for the storage of the cement.

Cement's each consignment delivered to the site shall be kept separately and the Contractor shall use the consignments in the order in which they are received. The cement shall be stored in the bags provided by the manufacturer and bags that have been opened shall be removed immediately. It shall be stored under cover on a floor raised at least 150 mm above ground and care shall be taken

to protect the cement from damp or other deleterious influences. Any cement that fails to comply with the above clauses, and which the Engineer considers to have deteriorated as a result of dampness or other causes shall be removed from the site immediately. Prolonged storage of cement on site is to be avoided and any cement stored on site for a period greater than 21 days shall be liable to rejection by the Engineer and, if so directed, the Contractor shall remove such cement from the site at his own expense.

Reinforcement of all types shall be stored on site in an approved manner, so as to avoid damage, on timber sleepers raised at least 300mm above ground. All reinforcement shall be free from loose scale, rust, oil, grease or any other matter that may impair the bond between the concrete and the reinforcement. If required by the Engineer, the reinforcement shall be thoroughly cleaned with wire brushes and immersion in chemicals.

2.2.26.2.6 Expansion Joints

The expansion joints in concrete structures shall be formed by means of bitumen impregnated softboard cast between the two adjoining edges of concrete with all of the joints taped to prevent leakage of the concrete. The contractor must take care of any irregularities of the expansion joints by ensure is not bridged at any point. They should be 30 mm wide unless otherwise shown on drawings.

At exposed faces, of expansion joints, the softboard shall be cut back on completion of the structure and the joint sealed with a closed cell extruded polyethylene foam and a sealant suitable for use in warm countries. Where polyethylene foam cannot be used, a polyethylene tape shall be used instead. The sealant shall conform to BS 2499, BS 5212, BS 6093 and BS 6213, as appropriate, shall be non-sagging, and it shall be based on a polyurethane, polysulphide or other synthetic compound approved by the Engineer.

The sealant shall be applied in accordance with the manufacturer's printed instructions and the colour shall be approved by the Engineer. Sealants and water stops shall be fit for bridging the expansion joints without damage during their design life.

2.2.26.2.7 Construction Joints

The positions of construction joints are to be as indicated on the drawings unless otherwise approved by the Engineer and shall be so arranged as to minimize the possibility of occurrence of shrinkage cracks. Joints in suspended slabs shall be located within the middle third of any slab or beam span and joint spacing in walls and slabs on ground shall not exceed 8m unless otherwise approved by the Engineer.

Surfaces of existing concrete are to have the aggregate exposed with a light power tool over all contact areas except within 25 mm of permanently exposed faces after 24 hours from the concrete application.

The face shall be thoroughly saturated with water so that the construction joint is in a saturated, but surface-dry condition. The use of grout or mortar on the joint shall not be permitted. The use of adhesives and/or galvanized expanded metal lathing at construction joints may be allowed with the prior approval of the Engineer.

2.2.26.2.8 Protective Membrane

All concrete in contact with the ground shall be protected by a continuous impervious membrane (1200 gauge thick polythene sheeting and bitumen emulsion), double folded and taped at the joints and sufficiently robust to avoid being damaged by the placing and compaction of backfill material and

be applied according to the manufacturer's instructions.

2.2.26.2.9 Cast-In Fixings and Sundry Items

The Contractor shall be responsible for accurately casting in the concrete work or fixing to the formwork any fixings, ties, dowels, slots, holding down bolts, etc, required for securing blockwork, precast concrete work, steelwork or electrical and mechanical services for other trades and suppliers.

Provision shall be made for forming holes, chases, ducts, rebates, the building in of pipes, conduits and other fixings as shown on the drawings. Holding down bolts and washer plates shall be firmly set in the formwork in taper boxes, polystyrene blocks or other approved sleeves as shown on the drawings. After concreting, but before the concrete has set, the bolts shall be ruled and loosened so that they are free to move in the finished work.

The Contractor shall provide dovetailed raglets to receive the top edge of foundation sheet and/or layered waterproofing, and to receive flashings in the outer face of concrete walls, upstands, beams, plinths, etc.

2.2.26.2.10 Sundry Items

2.2.26.2.10.1 Bitumen Impregnated Softboard

Bitumen impregnated softboard to BS should be fixed to form expansion joints and the softboard should be cut to size and cast against one face of the concrete and then the formwork removed. In expansion joints at suspended slabs the softboard shall be fixed at intervals with copper nails driven through and into the concrete to avoid fall out of the board. The exposed edges of the softboard should be pointed with a proprietary non-hardening sealant of proven suitability in the prevailing climatic conditions.

Softboard is also to be used at joints where specified as compressible joint filler on the drawings or requested by the Engineer. The filler shall be cut to exact widths and shall have all edges neatly trimmed and recessed as required. Fixing of the filler shall be strictly in accordance with the manufacturer's printed instructions. Joint fillers shall comply with the requirements of DOT Specification for Highway Works.

2.2.26.2.10.2 Waterstops

Waterstops where specified shall be PVC waterstops complying with BS 2571 and BS 2782. Waterstops shall be installed strictly in accordance with the manufacturer's instructions and to the Engineer's satisfaction to form a continuous diaphragm in each joint. Waterstops shall be supported and protected during the progress of the work.

2.2.26.2.10.3 Chemical Hardener

A chemical hardener where specified shall be used to harden and dustproof concrete strictly in accordance with the manufacturer's instructions. It shall be a colourless aqueous solution containing a blend of magnesium and/or zinc fluosilicates.

2.2.26.2.10.4 Eponite

"Eponite Clear Sealer" and "Eponite G23" manufactured by Colas Ltd or similar and approved two part epoxy resins shall be used for sealing and coating concrete and similar surfaces strictly in accordance with the manufacturer's instructions.

2.2.26.2.10.5 Xypex

"Xypex" manufactured by Fullstop Technology Ltd or similar and approved shall be used to waterproof and protect concrete strictly in accordance with the manufacturer's instructions.

2.2.26.2.10.6 Sikaflex-1A

"Sikaflex-1A" manufactured by Sika AG or equal and approved shall be used to seal joints strictly in accordance with the manufacturer's instructions. The sealant shall comply with USFS TT-S-00230C.

2.2.26.2.10.7 Burke-O-Lith

"Burke-O-Lith" manufactured by Burke or equal and approved shall be used to harden and dustproof concrete strictly in accordance with the manufacturer's instructions.

2.2.26.2.10.8 Burke Para-Flex

"Burke Para-Flex" manufactured by Burke or equal and approved shall be used as a waterproof coating for concrete and masonry structures strictly in accordance with the manufacturer's instructions.

2.2.26.2.10.9 Ethafoam

"Ethafoam" manufactured by DOW Ltd or equal and approved shall be used as a backup material in joints strictly in accordance with the manufacturer's instructions.

2.2.26.3 Methodology

2.2.26.3.1 Reinforcement – Bending Reinforcement

Bending of reinforcement shall be in accordance with BS 8666 and CYS EN ISO 3766. All reinforcement shall be bent cold. Re-bending of high yield reinforcement will not be permitted. The Contractor should prepare bending schedules for all parts of the work, based on the drawings and sketches provided by the Engineer. These should be submitted to the Engineer for approval prior to concreting. All reinforcement shall be bent sufficiently in advance of the concreting programme.

The Contractor shall provide facilities on site for bar cutting and bending.

The Engineer may require tests to be conducted on a random sample of bars selected by the Engineer. These tests will comprise:

i. Tensile test (in accordance with CYS EN 10002-1)
ii. Bend tests (in accordance with BS 4449)

For each test 3 specimen lengths (of approximately 2 metres) from each of 8, 10, 12, 16, 20, 25 and 32mm diameter reinforcing bars will be taken.

The Contractor is to allow for the cost and execution of one such set of tests for each consignment.

If the test results show that the steel does not comply with the relevant British Standard, the Contractor shall be responsible for carrying out at his own expense further tests as required by the Engineer, until it is established that the material proposed is complying with the relevant Cyprus/ British Standard.

2.2.26.3.2 Reinforcement – Bending Reinforcement

All reinforcement shall be rigidly fixed in position and the concrete cover shown on the drawings shall be carefully maintained. The placing of spacers and chairs shall comply fully with the requirements of Report CS101 of the Concrete Society.

Where concrete cover blocks are used to maintain cover, they shall not exceed 50 mm square in section and shall be securely wired to the reinforcement to ensure that they are not displaced when the concrete is poured. They shall be made of similar mix proportions and strengths as the adjacent concrete.

If it is necessary to provide "chairs" or other subsidiary reinforcement not shown on the drawings to keep the reinforcement in position, the Contractor shall not be entitled to additional payment for providing same. The concrete cover to any subsidiary reinforcement shall not be less than that over the reinforcement adjacent to it.

At intersections, the reinforcement bars shall be bound together with tying wire and the loose ends of the wire shall be turned towards the inside of the member.

No splices shall be made in the reinforcement except where described in the drawings or where approved by the Engineer. Offset laps in adjacent widths to prevent continuous laps in either direction. The Contractor shall provide adequate scaffold boards or similar to ensure that the reinforcement is not displaced by being walked upon during the placing of the concrete or other operations.

Steel fabric shall be installed in as long lengths as practicable, adjoining pieces shall be lapped at least two full meshes, and laced with wire.

2.2.26.3.3 Concrete Quality

The mixes shall be designed generally in accordance with the requirements of CYS EN 206-1 and BS 8500 Parts 1 and 2. Mixes for the grades of concrete shown in Table 3.6.1 shall be designed by the Contractor. The grade is denoted by the minimum 28 day works cylinder and cube strengths, e.g. C30/35. The cement content in any mix shall not exceed 550 kg per cubic metre of concrete. The quantity of water shall not exceed that required to produce a concrete with sufficient workability to be placed and compacted where required.

Complete calculations for the mix proportions and the information and assumptions on which they are based, shall be submitted to the Engineer before any preliminary strength cubes are made. The maximum free water to cement ratio shall not be greater than 0.5 by weight of cement for any mix. The Engineer's review of materials is for general applications, features and colour only. Structural performance of materials as specified is the Contractor's responsibility.

2.2.26.3.3.1 Design Mix Details

Where concrete is specified to be made with sulphate resisting cement the mix shall be designed with a maximum water/cement ratio of 0.45. Concrete in contact with the ground and/or water shall also be designed with a maximum water/cement ratio of 0.45. Mass concrete shall be grade C10/15 with 20-5 mm nominal size graded aggregate. The design mix details table 3.6.1 gives the minimum cement content for each type of concrete. The exact quantity of cement to give the specified concrete strength shall be determined in accordance with CYS EN 206-1 and BS 8500 Parts 1 and 2.

2.2.26.3.3.2 Trial Mixes

Trial mixes shall be made of three separate batches of concrete for all mixes specified. Cube results attained from these mixes shall be tested in accordance with BS 1881. No structural concrete shall be placed in the works until the relevant mix is approved by the Engineer. Any adjustments found to be necessary shall be made in accordance with the provision of BS 8110, and are subject to the approval of the Engineer. When the mix has been approved by the Engineer, no variations shall be made in the proportions, the original source of the cement and the aggregate, or in the type, size and grading zone of the latter, without the consent of the Engineer who may under these circumstances require further tests to be made.

2.2.26.3.3.3 Admixtures

The use of admixtures and additives to promote workability, impermeability, strength or any other property of the concrete shall only be allowed with the prior approval of the Engineer. When the mix and the admixture have been approved by the Engineer, no variations shall be made without the consent of the Engineer who may under these circumstances require further tests to be made.
The admixtures and additives shall comply with the following minimum requirements:

i. Accelerating, retarding and water reducing admixtures shall comply with the requirements of CYS EN 480 and CYS EN 934 and/or ASTM C494, Types A, B, C, D and E depending on composition, properties and dosage.
ii. Air-entraining admixtures shall comply with the requirements of CYS EN 480 and CYS EN 934 and/or ASTM C494, Types A and D, and/or ASTM C260 depending on composition, properties and dosage.
iii. Super plasticizing admixtures shall comply with the requirements of CYS EN 480 and CYS EN 934 and/or ASTM C494 Types F and G depending on composition, properties and dosage.
iv. Integral waterproofing admixtures shall be used strictly in accordance with the manufacturer's instructions and to the satisfaction of the Engineer. They shall comply with the requirements of the French Standard NFP.18-103 regarding classification, definition and marking.
v. Condensed silica fume (CSF) admixtures shall be used strictly in accordance with the manufacturer's instructions and to the satisfaction of the Engineer. CSF shall comply with the requirements of the relevant standard of Norway and with the "Guide for the use of silica fume in concrete" reported by ACI Committee 234.
vi. Migrating corrosion inhibiting (MCI) admixtures shall be used strictly in accordance with the manufacturer's instructions and to the satisfaction of the Engineer.

Admixtures and additives containing calcium chloride or more than 0.1% chloride ions shall not be permitted.

2.2.26.3.3.4 Mixing Concrete

Unless otherwise agreed by the Engineer, concrete shall be mixed in an approved type of mechanical weigh batcher. No hand mixing will be allowed.

The weighing and water dispensing mechanisms shall be maintained in good order and checked against accurate weights and volumes when required by the Engineer.

Design Mix Details Table - Mix Designation

Grade (cylinder/cube)		**C15/20**	**C20/25**	**C25/30**	**C30/35**	**C35/40**
Characteristic strength of concrete	Mpa	20	25	30	35	40

Specified works cube strength at 28 days	Mpa	20	25	30	35	40
Specified works cube strength at 7 days	Mpa	16	20	24	28	32
28 day target mean cube strength (Standard deviation = 4.0 Mpa)	Mpa	27	32	37	42	47
28 day target mean cube strength without evidence of standard deviation. Margin taken to be 15.0 Mpa	Mpa	35	40	45	50	55
Maximum coarse aggregate size	mm	20	20	20	20	20
Minimum cement content	kg/m3	300	340	360	390	410

Notes

i. For sulphate resisting concrete use sulphate resisting cement (BS4027)
ii. For sulphate resisting concrete minimum cement content to be increased by 40 Kg/m3 for each grade of concrete.
iii. The standard deviation of 4 MPa is the absolute minimum it can be considered under a very high standard of quality control.

The weights of cement and each size of aggregate as indicated by the mechanisms employed shall be within a tolerance of ±2 percent of the respective weights per batch agreed by the Engineer. The weight of the fine and coarse aggregates shall be adjusted to allow for the free water contained in the fine and coarse aggregates which shall be determined by the Contractor by a method approved by the Engineer immediately before mixing begins and further as the Engineer requires. The materials shall be mixed until they are uniformly distributed and the mass is of uniform consistency and colour but in no case shall the mixing time be less than two minutes after all the materials have been added to the drum. The drums of all mixers shall revolve at the speeds recommended by the manufacturers.

Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed. Unless otherwise agreed by the Engineer, the first batch of concrete throughout the mixer shall then contain only two thirds of the normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

2.2.26.3.3.5 Ready Mixed Concrete

Ready mixed concrete from an approved central mixing plant may be used provided it complies with the requirements of this Specification, with respect to materials, proportions, water/cement ratio, slump and strength, and in addition complies with the requirements of CYS EN 206-1 and BS 8500 Parts 1 and 2.

The concrete shall be brought to the site in an approved type of agitator truck and during transport it shall be agitated continuously at the rate specified by the manufacturer of the truck as the agitating speed.

2.2.26.3.3.6 Pumped Concrete

If it is the Contractor's intention to transport concrete by pumping, he is to obtain the Engineer's written approval at the commencement of the contract. The foregoing clauses on mix design shall apply equally to a concrete that is designed to be "pumped".

2.2.26.3.3.7 Quality Control of Concrete

A slump test shall be carried out in accordance with the requirements of BS 1881 whenever the Engineer may require it and in any case not less than the average rate of one test per 25 cubic metres of concrete mixed on site, or one test per load of ready mixed concrete. The water/cement ratio shall be the minimum necessary for workability.

The slump shall be 80-130 mm for all grades of concrete. Concrete containing a super plasticizer shall have a slump not exceeding 230mm after the addition of the super plasticizer to a verified 50-80mm slump concrete.

Works test cubes shall be 150 mm cubes, made, cured and tested in accordance with the requirements of BS1881 from samples of concrete taken from the point of deposition.

Samples shall be taken for every 25 cubic metres of concrete placed with a minimum of one sample taken every day on which a mix is used. From each sample, 6 cubes shall be made, two for testing seven days after casting and two for testing twenty-eight days after casting.

The other two cubes shall be retained in reserve for later testing as directed by the Engineer. Higher or lower rates of sampling may be implemented at the discretion of the Engineer taking into account the nature of the work.

The results of the tests shall be analysed in accordance with the procedure laid down in BS 8110. All cubes shall be clearly marked with the date of casting and accurate records shall be supplied to the Engineer, stating the dates of taking and testing samples, together with the results of tests and the exact position from which the sample was taken.

If ready mixed concrete is supplied from more than one plant, then, the number of test cubes stated shall relate to each plant.

If, in the opinion of the Engineer, from the evidence of the cube test, the concrete is not likely to be capable of fulfilling its purpose, the Engineer shall require 3 cores to be taken from the area represented by the test cubes. The actual location shall be decided by the Engineer.

These cores shall be taken and tested in accordance with the requirements of BS 1881 and if the average of the three cores when reduced to the corrected equivalent test cube strength at 28 days falls below the specified strength, further cores are to be cut in order to determine the extent of the unsatisfactory concrete. The volume of concrete shown to be below the required strength shall be taken out and replaced. All the above costs shall be at the Contractor's expense. Non-destructive testing may be permitted, but it shall not be used as the sole basis for acceptance or rejection.

2.2.26.3.4 Formwork

Formwork shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support. The Contractor shall submit for review shop drawings for fabrication and erection of formwork for all finished concrete surfaces.

The Engineer's review is for general applications and features only. The design of the formwork for structural stability, efficiency and safety is the Contractor's responsibility.

All formwork shall be designed and so constructed that there shall be no loss of material from the concrete or unacceptable deflection. After hardening, the concrete shall be in the position and of the shape, dimensions and surface finish described in the Contract.

All formwork whether metal or timber shall be securely placed and supported to prevent ragging and bulging. All joints are to be closed to prevent leakage of liquid from the concrete, with special care being taken where vibration of concrete will take place. Formwork panels shall have true edges to permit accurate alignment at sides and provide a clean line at the construction joints in the concrete. The Contractor shall erect the formwork in the largest practicable sizes to minimize the number of joints and to conform to the joint system shown on the approved shop drawings.

All propping to formwork shall be positioned so that it does not overstress any part of the completed structure. The props shall be left in position until the new construction is sufficiently strong to support its own weight together with additional incidental loads.

Formwork shall be constructed so that the side forms of members can be removed without disturbing the soffit forms. Unless otherwise stated on the drawings, the formwork to all slabs and beams shall be constructed with the following upward camber:-

Beams and slabs spanning between supports - 7 mm for every 5 m of span
Cantilever beams and slabs - 12 mm at free end for every 3 m of span

Where internal metal ties are permitted, they or their removable parts shall be extracted without damage to the concrete and the remaining holes filled with latex modified mortar.

The design and construction of formwork shall comply with the requirements of Report CS030 of the Concrete Society and BS 5975.

2.2.26.3.4.1 Formed Surface – Classes of Finish

The classes of finish for formed surface shall be as follows:

i. **Sawn Formwork (Type A):** This shall be designed formwork or moulds of closely jointed sawn boards or other approved material. Small blemishes due to entrapped air or water shall be allowed but the surface shall be free from voids, honeycombing or other large blemishes.

ii. **Wrought Formwork for "Fair Face" Finish (Types B, C and D**): Where concrete is described as having "Fair Face" finish it shall have a "Type E" finish to the surface in accordance with BS 8110.This finish shall be a high quality hard smooth finish resulting from a high quality concrete with forms or moulds having a hard smooth finish. The concrete surface shall be smooth with true clean arrises and only very minor surface blemishes shall be allowed with no staining or discolouration from release agents. Whilst the concrete is still green, fill all surface blemishes with a fresh specially prepared cement and fine aggregate paste. Every effort shall be made to colour match the concrete. After the concrete has been properly cured, the faces shall be rubbed down where necessary to produce a smooth, even and uniform textured surface. The Contractor shall ensure that permanently exposed concrete surfaces are protected from rust marks, spillage and stains of all kinds.

iii. **Type B:** Formwork type B is to be wrought timber with joints tightly butted and regular in pattern. Where two or more widths are used on one face, they are to be equal and joints between lengths are to be staggered.

iv. **Type C:** Formwork type C is to be formwork lined with waterproof oil tempered plywood or approved equivalent material, to give a perfect smooth finish.

v. **Type D:** Formwork type D is to be formwork of wrought tongued, grooved and vee-jointed boarding in 100 mm widths with joints tightly butted and regular in pattern with staggered longitudinal joints, the whole to produce a smooth patterned surface to the approval of the Engineer.

vi. **G.R.P. Formwork:** Formwork for fair faced waffle floor slabs should be of G.R.P. standard waffle pans. The required dimensions and grid to be as per detail drawings.

vii. **Sliding Formwork:** Concrete members, where indicated or agreed, shall be constructed using the slip form method of construction. The contents of other specification sections on concrete shall be applicable to this section with the following additional clauses:

2.2.26.4 Preparatory Actions

The Contractor shall, not later than 8 weeks before the planned start of the slip forming, forward the following to the Engineer for approval:

i. Drawings of the slip form structure and all associated equipment.
ii. A list of all standby equipment to be utilized on the slip form structure.
iii. A list of key personnel vital in the continuous operation of the slip form together with back-up personnel to cover for accidents, absenteeism etc.

The Engineer's approval of the slip form method will not indemnify the Contractor from his responsibility for the structural adequacy and stability of the slip form structure.

The Contractor shall not later than 6 weeks before the planed start of the slip forming forward to the Engineer for his approval a detailed slip forming programme comprising the following:

i. The start date and completion dates of the slip forming operation, showing the periods required for erection and dismantling of the slip form structure.
ii. Slip forming schedules giving detailed information on reinforcement, location of openings, recesses, cast in items, pull out bars, etc shown in relation to levels commencing from bottom to top.
iii. List of on call service personnel for the maintenance of all equipment to be utilized on the slip form.
iv. Emergency procedures with regards to an alternative supply of concrete on a 24 hour basis.
v. Emergency electricity supply on a 24 hour basis.
vi. Emergency procedures with regards to the safety of personnel.
vii. A specification for the control of the correct concrete mix design, constant supply of concrete and checking and maintaining the correct alignment of the slip form.

The Contractor must indicate a back-up batching plant during slip forming. Supply of concrete from an alternative batching plant including transport time to the site shall be within a period of 30 minutes. The alternative concrete supply shall be of the exact mix design as the primary batching plant and this shall be confirmed by testing of the concrete from both plants.

All costs in relation to standby plant, equipment and personnel shall be included in the Contractor's tender prices.

The slip forming shall not commence until the slip form programme has been approved by the Engineer.

The Contractor shall carry out all the necessary fencing and marking of the safety zone around the slip forming area and shall liaise with the Local Authorities with regards to obtaining the necessary approvals for the slip form arrangement and safety procedures.

2.2.26.4.1 Tolerances

The following tolerances apply for the slip forming of concrete members as indicated or agreed:

Internal diameter of circular members	+/- 15mm
Other internal measurements	+/- 15mm
Thickness of the walls	+ 20mm - 0mm
Levels	+/- 20mm
Centres deviation from plumb (on minimum 4 checkpoints around the walls of each member at a frequency of every 12 hours)	+/- 15mm

All setting out of horizontal measurements shall be carried out using the vertical centre of the sections. For cast-in items, openings and recesses the following tolerances shall apply:

Levels (absolute)	+/- 20mm
Levels (relative to each level)	+/- 5mm Horizontal placement
(relative to each level)	+/- 15mm

Cast-in items shall be free of concrete and shall be displaced maximum 15mm from the surface.

The vertical stop ends of openings shall always be set out perpendicular to the specified width.

2.2.26.4.2 Concrete Surface Treatment

Immediately after the concrete appears below the slip form any surface defects, after being brought to the Engineer's attention, shall be made good as instructed by the Engineer. All the wall surfaces shall be improved to a smooth rendered finish using a finishing trowel or similar, lightly rewetting the surface if necessary.
Immediately after, an approved curing membrane shall be applied to thefinished surface.
The chosen curing compound shall be a clear type as to avoid discolouring of the finished surface and must be of a type that disappears after some time to enable a surface treatment at a later stage.

2.2.26.4.3 Formwork

The form panels shall be manufactured of tight and smooth material e.g. steel sheets or water resistant plywood boards. The height of the form panels shall be between 1 and 1.2 meters.

The form shall be slightly tapered so that the spacing of the two form sides is equal to the wall thickness minus approximately 5 to 7 mm at the top of the form and plus approximately 5 to 6 mm at the bottom.

The yokes shall resist lateral concrete pressure and keep the desired form spacing. Rigidity of the yokes is of vital importance as is the rigidity of all the formwork.

To ensure rigidity adequate bracing must be provided. This bracing can serve a double purpose by incorporating the working deck at the level of the top side of the form enabling direct shovelling of concrete from the deck into the forms.

The jacking system shall be hydraulically operated jacks bearing against rods buried in the concrete. The stroke shall be approximately 25mm (8 strokes per hour gives a capacity of 0.20 meter per hour, 4.80 meters per 24 hours). The jacking system shall be able to lift the slip form with twice this speed

(9.60 metres per 24 hours), but casting shall not exceed 4.80 metres per 24 hours unless written acceptance is obtained from the Engineer. The jacks shall permit adjustment of the stroke to enable levelling of the platform.

The jack rods can be left in the walls or removed after use. Where rods pass through large openings they must be braced adequately or a provisional column structure shall be cast around them.

The Contractor may propose other procedures including details of construction joints and time schedule for slip forming works, but any such proposals shall be to the Engineer's approval.

2.2.26.4.4 Inspection of Slip form Equipment

The slip form formwork and all associated equipment such as yokes, jacks, jacking rods etc, shall be inspected by the Engineer prior to shipping to Cyprus.

Two inspections shall be made:

i. The first inspection is to establish the minimum standard of finish required for the formwork facing panels. The Contractor shall notify the Engineer when a trial panel of sufficient size to be representative of the whole slip form arrangement has been prepared.
ii. The second inspection is to be made when all the equipment has been finished to the standard established by the Engineer during the first visit and prior to its being packed for shipping.

If at the second inspection any item of the slip form equipment is found not to be to the Engineer's satisfaction, then the Contractor shall carry out any repairs, alterations and modifications to the equipment as instructed by the Engineer and shall not be entitled to any claim for additional costs and/or damages and/or delays.

Notwithstanding any of the above, the Contractor shall not be relieved from his obligations arising from the Contract and he shall be solely responsible for providing slip form equipment adequately designed so as to carry out the work as specified.

2.2.26.4.5 Reinforcement

All reinforcement shall be cut, bent and marked in accordance with the slip forming schedule before the start of slip forming. The vertical reinforcement shall be placed and held in position by templates placed on the slip form. In addition to these templates, a number of U-bars shall be provided and placed between the two layers of reinforcement to assure correct alignment.

The vertical reinforcement shall be in maximum 6 metre lengths. Only one third of the vertical reinforcement shall be lapped at the same level. The laps shall be evenly distributed and the three staggered laps shall be placed at maximum distance of approximately 2m. The lap length shall be clearly marked with paint on the bars enabling correct lapping and to maintain the three lap levels at maximum distance.

The horizontal reinforcement shall be placed nearest to the wall surfaces unless otherwise shown on the drawings. To assure the correct distance between the horizontal bars the placement of these bars shall be marked on the vertical reinforcement at minimum one place between every yoke internally and externally.

The lapping of the horizontal reinforcement shall be evenly distributed along the whole circumference with a minimum distance of one meter between the laps. Minimum lap length shall be marked at the ends of the horizontal reinforcement bars. The horizontal reinforcement shall be fixed to the vertical reinforcement at every other crossing.

2.2.26.4.6 Concrete Mix Design

Two weeks prior to the commencement of slip forming, the Contractor shall propose the rate of slip desired. By test or otherwise a mix permitting this slip speed shall be obtained. A range of mixes for various ambient conditions may also be proposed.

Having decided on a mix the setting time of the concrete shall be measured by the methods of BS 4550.

A definition of setting time shall be agreed with the Engineer. The vibration limit or a penetration resistance figure corresponding to a partial initial set shall be adopted as the "setting time".

Throughout the duration of the job the concrete supplied shall have a setting time comparable with the test mix irrespective of ambient conditions. The permitted latitude on setting time shall be agreed between the parties concerned, but in no case shall the measured setting time be permitted to deviate from the agreed figure by more than 30 minutes.

Concrete for test for setting time shall be sampled at the mixer. Test specimens shall be stored under conditions such that their temperature does not deviate by more than, 2.5C from the ambient temperature measured on the slip form deck. The temperature shall be measured at the time of placing the concrete.

The frequency of sampling and testing for setting time shall be every 12 hours during the slip forming operation and each time there is a change in either concrete mix or the batching plant, or as directed by the Engineer.

The Contractor shall exercise close control to achieve the above setting time and shall as required, either:

i. Modify the mix proportions, or
ii. Modify the dosage of admixture or
iii. Modify the temperature of one or more of the materials.
to ensure that the agreed setting time is consistently achieved.

Similarly, the slip form operator shall exercise close scrutiny of the performance of the concrete in relation to any given rate of jacking of forms and he shall modify the rate of climb as required to ensure satisfactory results in the event of variations in concrete delivery time, slump or setting time or sudden changes in ambient conditions. It is the Contractor's responsibility to monitor the supply of concrete to ensure that the correct setting time is maintained so as to avoid damage to the partly set concrete as it leaves the formwork.

2.2.26.4.7 Transporting Handling and Placing

Concrete shall be landed on the deck and from there it shall be shovelled into the forms in even layers of approximately 150mm and vibrated. Placing of concrete shall be continuous and supply of labour and materials shall be organized so as to facilitate continuous operation on a 24 hour basis.

Care must be taken when vibrating freshly placed concrete so as not to disturb the lower layers of previously placed concrete.

The maximum time allowed for placing of the subsequent layer is one hour, and the concrete supply, the crane coverage and the supply of labour shall be sufficient to fulfil this requirement.

Horizontal construction joints shall be avoided. If for any reason whatsoever a stoppage is necessary, the break shall be treated as specified for construction joints. If a stoppage should occur above the hopper a 100 x 1.0 mm galvanized steel sheet shall be placed in the centre of the wall in the construction joint.

Slip forming shall continue during wet weather even during heavy rain. The water content of the mix shall be adjusted accordingly to account for the calculated amount of rainwater falling onto the slip form. An electronic rain meter shall be installed at the mixing plant in order to record the rain intensity on Site to enable the above adjustments to be made.

2.2.26.4.8 Test Cubes

Concrete cubes shall be cast on site. Four batches of each of 3 cubes shall be made every 24 hours. One third of the cubes shall be tested after 3 days, one third after 7 days and the remaining third after 28 days. Molds for 3 cubes shall always be available on site for casting of additional cube on the Engineer's instruction. In case of change of mixing plant 3 extra cubes shall be cast from the first delivery from the new plant.

2.2.26.4.9 Preparation of Formwork Before Concreting

The inside surfaces of forms shall, except for permanent formwork, or unless otherwise agreed by the Engineer, be coated with an approved material to prevent adhesion of the concrete.

Release agents shall be applied in accordance with the manufacturer's instructions and shall not come into contact with the reinforcement. Mould release agents shall not be used on formwork to concrete which will be visible in the finished works. When concrete surfaces are to receive an applied finish, the Contractor shall ensure that the release agent used will not affect the finish or bonding to the concrete.

Immediately before concreting, the Contractor shall ensure that all wire clippings, dirt, shavings, loose concrete and any other refuse has been removed.

2.2.26.4.10 Unformed Beds

The classes of finish for unformed beds shall be as follows:

i. Tamped Finish

The concrete shall be uniformly levelled and screeded to produce a plain or ridged surface as described in the contract. No further work shall be applied to the surface unless it is used as the first stage for a floated or trowelled finish.

ii. Floated Finish

After the concrete has hardened sufficiently, the concrete tamped surface shall be floated by hand or machine sufficiently only to produce a uniform surface free from screed marks.

iii. Trowelled Finish

When the moisture film has disappeared and the concrete has hardened sufficiently only to prevent laitance from being worked to the surface, a tamped surface shall be steel-trowelled under firm pressure to produce a dense, smooth uniform surface free from trowel marks.

2.2.26.4.11 Removal of Formwork

The Engineer shall be informed in advance when the contractor intends to strike any formwork.

The time at which the formwork is struck shall be the Contractor's responsibility, but the minimum periods between concreting and the removal of forms shall be as follows:

Sides of beams, walls and columns	-	24	hours
Soffits of slabs (Props left in)	-	7	days
Removal of props to slabs	-	10	days
Soffits of beams (Props left in position)	-	10	days
Removal of props to beam soffits	-	21	days

The periods stated above, are based on a constant surface temperature of the concrete of 16^{o}C and the use of Ordinary Portland or Sulphate Resisting Cement. They shall be increased during colder weather or reduced during hot weather as directed by the Engineer and may be changed if other types of cement are used subject to the Engineer's agreement.

If props are to be left in place when the soffit forms are removed, these props shall not be disturbed during the striking.

All formwork shall be removed without damage to the concrete. Where it is intended that formwork is to be re-used, it shall be cleaned and made good to the satisfaction of the Engineer, prior to it being permitted for re-use and a new coat of the release agent shall be applied as approved for new formwork. "Patched" formwork for exposed concrete surfaces shall not be permitted.

2.2.26.4.12 Ties

The Contractor shall submit to the Engineer for approval details of any ties or cast in fixings that he proposes to use in connection with his formwork. Any embedded metal ties shall not have any part of the tie closer to the finished concrete surface than the specified thickness of cover to the reinforcement. Holes left after removal of any ties shall be filled with latex modified mortar.

2.2.26.5 Transport and Placing of Concrete

The method of transporting and placing concrete shall be in accordance with CYS EN 206-1 and BS 8500 Parts 1 and 2 and subject to the Engineer's agreement.

Concrete shall be so transported and placed that contamination, segregation or loss of constituent materials does not occur.

All formwork and reinforcement contained in it shall be clean and free from standing water immediately before the placing of the concrete.

Concrete shall not be placed in any part of the structure until the Engineer's approval has been given. Submit at the beginning of each month, for the Engineer's approval, the concreting programme for that month, stating placing dates, so that adequate checking and supervision can be provided before and during the placing operation. Submit for review the locations, details and method of construction of all joints in slabs on grade, suspended slabs and walls.

The Contractor must give 24 hours notice to the Engineer for pre-pour inspection.

Any inspections made by the Engineer do not relieve the Contractor from his liability to replace materials which prove to be faulty and do not comply with this Specification.

If concreting is not started within 24 hours of approval being given, approval shall again be obtained from the Engineer. Concreting shall then proceed continuously over the area between construction joints. Fresh concrete shall not be placed against in-situ concrete which has been in position for more than 30 minutes, unless a construction joint is formed in accordance with this Specification. Where in-situ concrete has been in place for 4 hours, no further concrete shall be placed against it for a further 20 hours. Concrete when deposited shall have a temperature of not less than 5 ?C and not more than 30? C except with the approval of the Engineer. It shall be compacted in its final position within 30 minutes of discharge from the mixer unless carried in purpose made agitators, operating continuously, when the time shall be within 2 hours of the introduction of water to the mix and within 30 minutes of discharge from the agitator provided the Engineer is satisfied that the concrete can be placed at the required workability. Where placement consists of several layers, each layer shall be placed while the preceding layer is still plastic to avoid cold joints.

Except where otherwise agreed by the Engineer, concrete shall be deposited in horizontal layers to a compacted depth not exceeding 300 mm and each layer shall be well consolidated before the subsequent layer is placed. Concrete shall not be dropped into place from a height exceeding 2 metres. When trunking or chutes are used, they shall be kept clean and used in such a way as to avoid segregation. Concrete shall not be pumped or discharged through aluminium or alloy conduits. Concreting shall be carried out continuously and no concrete shall be placed on concrete which has sufficiently set as to cause the formation of seams or planes of weakness within the section. Where concrete cannot be placed continuously joints, as specified, shall be formed only where shown on the drawings or approved by the Engineer.

In case the Contractor may consider a local increase in workability desirable, such increase may not be obtained by increasing the water content of the mix. It may, if authorised, be obtained by the addition of a mortar consisting of sand and cement in equal proportions mixed to the necessary consistency but not having a water/cement ratio exceeding that in use of the concrete mix or by the addition of an approved plasticiser.

During placing of concrete in reinforced concrete work, a competent steel fixer shall be present.

No concrete shall be placed in flowing water. Underwater concrete shall be placed in position by tremies or by pipeline from the mixer. Full details of the method proposed, shall be submitted in advance to the Engineer and his approval obtained before placing begins.

Where the concrete is placed by tremie, its size and method of operation shall be in accordance with BS 8004 "Code of Practice for Foundations". During and after concreting under water, pumping or dewatering operations in the immediate vicinity shall be suspended until the Engineer permits them to continue.

2.2.26.5.1 Compaction of Concrete

All concrete shall be compacted to produce a dense homogeneous mass. Unless otherwise agreed by the Engineer, it shall be compacted with the assistance of mechanical vibrators, and sufficient mechanical vibrators in serviceable condition shall be on site so that spare equipment is always available in the event of breakdowns.

Mechanical vibrators shall be of the immersion type capable of producing not less than 10,000 cycles per minute or of the external type capable of producing not less than 3,000 cycles per minute.

No vibrator shall be operated by a workman who has had insufficient training in its use.

With immersion vibrators, the tubular part of the tool shall be inserted vertically into the full depth of the concrete to be vibrated at points 600 mm apart and at least 100 mm away from any formwork. The vibrators shall be kept constantly moving whilst in action to prevent segregation. Vibration shall not be applied directly or through the formwork or reinforcement to sections or layers of concrete which have taken their initial set or concrete which has ceased to become plastic under vibration. Vibration shall be stopped after the decrease in volume is no longer apparent or before localised areas of grout or laitance are formed. Should the supply of concrete from the mixer be interrupted, the vibrators should be lifted clear for the work.

The type and size of the vibrating equipment shall be in accordance with BS 2769, CYS EN 50144-1 and CYS EN 60745-1, and it shall be suitable for the work in hand. Full details of the vibrators proposed shall be submitted in advance to the Engineer and his approval obtained before placing concrete.

2.2.26.5.2 Curing of Concrete

Immediately after compaction and for 7 days thereafter, concrete shall be cured and protected against harmful effects of weather, including rain, rapid temperature changes, frost and from drying out. The methods of protection used shall be subject to the approval of the Engineer.

The method of curing used shall prevent loss of moisture from the concrete and the development of high temperature gradients. On concrete surfaces which are to be water-proofed curing membranes shall not be used. Water for all curing shall be fresh well water. Where water is used for curing concrete work buried in the ground, care should be taken to avoid excessive curing water from running below the foundation or the footing.

All concrete during setting and hardening shall be protected from shock, vibration or damage from any cause. Where damage does occur, all remedial work and consequential delays shall be at the Contractor's expense.

2.2.26.5.3 Special Measures for Cold Weather Working

The concrete shall be protected from physical damage or reduced strength which could be caused by frost, freezing/thawing actions or low temperatures, in compliance with the reports "Cold weather concreting" prepared by ACI Committee 306 and as herein specified:

i. When the air temperature has fallen to or is expected to fall below 4□C, the water and the aggregates shall be uniformly heated, before mixing, to obtain a concrete mixture temperature of not less than 10□C and not more than 27□C at the point of placement.
ii. Frozen material or materials containing ice or snow shall not be used. Concrete shall not be placed on frozen sub grade or on sub grade containing frozen materials.
iii. Calcium chloride, salt and other materials containing antifreeze agents shall not be used.
iv. Protection and curing of concrete shall be carried out by curing and sealing compounds, by maintaining formwork in place, by moisture and heat-retaining covers, and by combinations thereof, as shall be approved by the Engineer.
v. Concrete shall not be placed in frozen formwork or formwork containing ice or snow.

2.2.26.5.4 Special measures for hot weather working

The Contractor shall take special measures in hot weather to ensure that the temperature of the concrete when deposited does not exceed 30^{o}C and it shall not be placed when the shade temperature exceeds 43^{o}C.

Such measures are to be approved by the Engineer and shall include some of, or if necessary all of the following:-

1. With respect to aggregates
   Aggregate stock-piles sited in shade even if this has to be provided temporarily. Watering of stock piles shall not be permitted.
2. With regard to water
   i. Water for mixing obtained from the coolest possible economic source and may be cooled with ice or other means subject to the Engineer's approval.
   ii. Water storage tanks sited in shade, permanent or temporary.
   iii. Storage tanks insulated or buried below ground where site conditions permit.
   iv. All distribution pipes or water trucks insulated or painted white.
3. With respect to cement
   i. The cement store should be sited in the shade.
4. With respect to mixing and placing concrete
   i. The mixing plant and all delivery equipment sited in shade wherever possible and organised in such a way that the interval between mixing and placing is the absolute minimum.
   ii. Where shade is impossible provide equipment painted white and/or mixer drum insulated.
   iii. Immediately before concrete placing, formwork, reinforcement, cable ducts, etc, sprinkled with cool water fit for human consumption.

5. With respect to curing and protection:
   i. Proper curing with adequate protection from sunlight maintained continuously for a minimum period of 7 days.
   ii. Exposed surfaces always and, where practicable, shuttering protected from direct sunlight.
   iii. For most curing, the concrete shall be completely covered with absorbent material which shall be maintained in a wet condition by applying water in the form of a fine spray.
   iv. Membrane curing sheets of impermeable material shall be fixed in close contact with the concrete as soon as practicable after casting. If any drying has occurred, the hardened concrete shall be completely saturated with a fine spray before fixing the membrane. The edges and lapped points shall be held down to prevent the circulation of air.
   v. Sprayed curing compounds will not normally be permitted on surfaces which are to receive an applied finish. Where permitted they shall contain a fugitive dye to given visual indication of even and complete application.
6. Comply with the report "Hot weather concreting" prepared by ACI Committee 305.

2.2.26.5.5 Watertight Concrete for Water Storage

Where the concrete is described as watertight on the drawings and details, the Contractor is responsible for ensuring that the resulting construction is watertight. In the event of any leakages, the Contractor must carry out, at his cost, any remedial work required by the Engineer.

All water retaining structures shall be constructed in accordance with BS 8007 "Code of practice for design of concrete structures for retaining aqueous liquids".

All concrete work shall comply with BS 8110, BS8102, "Code of practice for protection of structures against water from the ground" and this Specification.

The combined aggregates used in the concrete mix shall have absorption of not greater than 3% measured in accordance with BS 812 and CYS EN 932-6, "Testing aggregates".

The concrete shall be a designed mix grade C30/35, or as previously described with the addition of a plasticiser and a waterproofing agent in the proportions recommended by the manufacturer and all to the approval of the Engineer. The water/cement ratio shall be 0.45.

Where holes are required through watertight construction, they are to be formed by casting in puddle flanged sleeves of a suitable diameter approved by the Engineer. The Contractor shall submit to the Engineer for approval details of ties and cast-in fixings.

All concrete shall be vibrated with internal vibrators and all construction joints and movement joints shall be provided with water stops.

All concrete kickers shall be cast monolithic with the structure and shall be 150 mm high.

The Contractor shall forward to the Engineer a layout of the positions of all joints in the watertight concrete construction for approval prior to commencement of work on site.

Particular attention is required to ensure the concrete is compacted around the water stops to avoid honeycombing and damage or displacement of the water stops.

Internal water stops shall be held firmly in position during casting by means of split stop ends or other approved methods. External water stops shall be securely anchored so that movement does not take place during casting. Details of all water stops to be used in the works shall be submitted to the Engineer for approval. Any leakage of the joints shall be made good to the Engineer's satisfaction and the cost of such work shall be at the Contractor's expense.

2.2.26.5.6 Over site Blinding Concrete

Oversite blinding concrete shall be laid with its top surface free of projecting aggregate, irregularities or ridges and shall be satisfactorily smooth so that polythene sheeting or bituminous membrane can be laid on the surface of the blinding without risk of puncturing or tearing.

2.2.26.5.7 Tolerances

Completed work shall comply with the requirements of BS 5606 and the following tolerances must not be exceeded. Any work falling outside the specified limits shall be liable to be condemned and to be demolished and reconstructed at the Contractor's expense. Any consequential costs arising from delays etc shall also be borne by the contractor.

i. Member section - dimensions in each direction ±5 mm.
ii. Position of members - centre lines in each direction ±5 mm.
iii. Vertical misalignment of members in each direction in storey height ±5mm.
iv. Horizontal misalignment of members (Lozenging) ±5 mm.

Note: - These tolerances shall not be cumulative and the maximum vertical misplacement of any horizontal surface shall not exceed ±10 mm.

2.2.27 [S29] Completion of Survey and Detailed Documentation during construction phase

2.2.27.1 Scope and application

While dealing with the conservation and rehabilitation Phase 1 of the Sourp Magar Monastery, the contractor's team will need to deal with pending detailed documentation of the structures which are currently in a dangerous and inaccessible location due to structural instability, debris, vegetation or other factors. The method to resolve the conflicts that arise between their current situation and having always in mind the requirements of health and safety legislation, especially with regard to safe access for the contractors team as well as potential inspection of the area while in Phase 1, has been decided to be as follow.

These reassures that the above mentioned special elements will not be exposed to any danger or further damage caused by workers, visitors or working equipment used, but at the same time, a complete and accurate documentation – while always having in mind the maximum provision of safety - will be recorded and completed to its maximum level for the Survey required by the assigned Contractors Team.

2.2.27.2 Methodology

2.2.27.2.1 Special Element – The Tower Arches

The Tower Arches, that currently need a more accurate and detailed Survey in both drawings and photo documentation due to their high height exposure, will need to have a temporary build up scaffolding erected from ground level to allow movement and safe access into the current 1st floor Arches area that lacks of flooring which prevents a close up look and access to the area.

The Work at Height Regulations 2005 were implemented to ensure the safety of employees while working at height. The regulations apply to all work at height where there is a risk of a fall likely to cause personal injury. All work at height must be risk-assessed, and safe via a suitable systems of work must be used to access the area, whether for inspection, survey purposes or maintenance. The Contractors team places as a requirement for the temporary scaffolding that will be erected on site to have fixed its fixtures to the existing openings which in that way will allow free access without the need of stairs, along with guard rails on the perimeter of the scaffolding, to reassure maximum safety, along with priority over personal protection measures (safety harnesses, for example). The installation of the secure fixings will have an impact on the character of the historic building and ferrous fixings may also harm its fabric. So, where their installation is considered necessary, they should be made from stainless steel and their location should be agreed following consultation with the relevant consultants and client, having obtained archaeologist's consent.

A tower or 'zip' scaffold is a quick and easy method to provide access to a workface, but the guidelines laid down by the manufacturer and HSE must be followed. Thought should be given to the tower height and plan form, wind conditions, horizontal forces, access, overloading, and the position of overhead services well in advance, after an on-site visit, prior to installation.

Access scaffold is the safest method of gaining temporary high-level access to carry out the survey. The scaffold should be erected by a suitably qualified and competent contractor and installed in accordance with the guidelines set out by the Work at Height Regulations 2005. Once erected, a completion certificate must be obtained before any operative is given access to the scaffold, and, for construction work, when using any form of platform from which a person could fall more than two meters, the team must ensure the platform is inspected in place every time before any use.

When working on the Monastery, the contractor must also be familiar with the conservation issues, including the need to use the minimum number of fixings to the historic fabric, and the need for the scaffold to be self-supporting wherever possible. If anchors are considered essential then only stainless steel fixings should be allowed. All tube ends must be covered with plastic caps to prevent damage to the historic fabric, and must not rest on or about the building. New or good condition scaffold tubes should be used to avoid the risk of rust staining to the walls. Any artefacts below the area of work should be protected or temporarily removed. All scaffolding structures should be properly earthed, and all scaffolded areas should be blocked when works are not taking place on site to avoid unauthorized visitors to access the area and expose themselves to danger.

Works must also be postponed while weather conditions endanger health and safety.

2.2.27.2.2 Special Element – Block C Windows

Block C Windows, that currently need a more accurate and detailed Survey in both drawings and photo documentation due to their high height exposure, will need to have an external temporary approach method in order to reach them as closely and safe as possible, which due to their height and inaccessible interior, prevents a close up look and an accurate survey documentation.

Where suitable and accessible in terms of level of access available around the building, the use of a mobile platform may be considered as a more reliable and useful solution. Mobile platforms comprise either a telescopic boom (a 'cherry picker') or a scissor lift. Both have their uses for carrying out inspection of a building's external fabric without touching or causing damage to the building, but also for carrying out any necessary maintenance that might be requested from the client, such as cleaning or undertaking minor repairs.

Furthermore, to reassure maximum safety, priority to personal protection measures (safety harnesses, for example) should always be taken while using the mobile platform.

2.2.27.2.3 Kitchen Beam and Cooking Area (or generic access to Block C upper floor rooms)

Kitchen Beam and Cooking Area (or in general Block C upper floor rooms), that are currently in need of a more accurate and detailed Survey in both drawings and photo documentation due to their dangerous flooring stage, will be dealt with the temporary measure of the introduction of the guarded walkways fixture, room access walkway planks from wall to wall (over doors and windows) and steady temporary fixings for any suggested walkway creation.

The main difficulty with providing shoring along the building is to ensure that their installation does not cause damage. Shoring will need to be designed by the structural engineer or other competent person – and its installation/placement on site should be done under the engineers guidance and observation.

The proposal of an erected scaffolding below on ground floor – up to the first floor flooring line, right under the current existing wooden beams - it is suggested, for the extreme case of a room that is exposed to a very high risk situation of floor beams or walls collapsing. All scaffolding structures should be properly earthed, and all scaffolded areas should be blocked when works are not taking place on site to avoid unauthorized visitors to access the area and expose themselves to danger.

Ideally the building should be designed to remove the need for temporary access, and thereby reduce the risk of falls from height.

2.2.27.2.4 Block B Locked Rooms

Block B Rooms that are currently in a very good condition but locked and inaccessible should be unlocked by the responsible authorities, to provide access to the contractor team, for a detailed survey documentation in drawings and photographic records.

2.2.28 [S30] Maintenance of Existing Doors and Windows

2.2.28.1 Scope and application

Most of the original doors in Block B are divided into wood panels and fixed wood frames with glass for window openings. Every effort should be made to retain as much of the existing detail as possible. If the old doors cannot be saved, their replacements should be the same size and type as the originals. Doors should be selected to capture the basic character of the original doors and to fill the entire original opening. Door frames when replaced should conform to the original style of architecture of the building. Do not use imitations of styles or embellishments that do not fit the period or style of architecture.

Windows are important to the scale and character of the building and to the composition of the building form. It is important to maintain the original size, shape and design of windows. It is also important to retain the wood trim that frames the window opening.

2.2.28.2 Methodology

Wooden Panels for Doors and Windows will be treated as described below, to maintain their best appearance and use as possible. Wooden Frames and wooden panels will need to be sanded in order to remove any sign of the existing paint. When the entire surface of the paint is removed, all wooden surfaces will need to be examined in case of any wood damages, termites, wear or decay.
In the scenario that no such issue is arisen, then the wooden surface will be treated with wood primer for its protection, left to be dry for 1 day, and then painted accordingly, to the same colours and thickness of paint as per original design. It needs to be noted that prior to any painting takes place, the door and frames surface needs to be entirely smooth and straight.
In the scenario where some wood planks or parts present issues, those wooden parts will need to be replaced. Their replacements should be the same size and material type as the originals. Afterwards, the wood primer will be applied for its protection, left for drying for 1 day, and then painted accordingly, to the same colours and thickness of paint as per original design. It needs to be noted that prior to any painting takes place, the door and frames surface needs to be entirely smooth and straight.
Lastly, glassed surfaces will need to be well kept while the wooden frame will be treated, and installed back to position as per original design, with care. Throughout cleaning of all glassed surfaces will take place after the installation of the windows.

3 Safety and Visitors Accessibility

3.1 Safety measures before initiating any type of work

The below content included in sub category 1.0, has been prepared by the assigned Health and Safety in order to advice the consultant team of this specific project, about the health & safety requirements / specifications of the working routes / corridors during construction works for the renovation of the church inside the monastery.
The content is based on the information collected by the consultant during the site visit at the Monument and during the meetings with the consultant team. It outlines the basic health & safety requirements for the working corridors / routes during construction, to be furtherly elaborated during the final report stage prior to construction stage.

3.1.1 General Warnings

All corridors/ passage ways should always be clean, accessible and available to the workers. If there are obstacles, these should be moved. In the corridors/ passage ways there should not be any branches or plantations that could cause accidents or injuries to workers. Also, no machinery, materials etc. should be placed in the corridors/ passage ways.

3.1.2 Low height points

If there are low height points/ obstacles where there is a risk of head injury, then an alternative route should be available, or the low height point/ obstacle should be removed, or markings should be available for informing staff in order to avoid injury.

3.1.3 Flooring

All floors and passage ways should have smooth surfaces without openings or other points where the worker could stumble. Also, these should not be slippery (whether wet or not). Additionally, floors/ passage ways should be able to hold the load that will be moved through them (e.g. in cases where passage ways are the ceilings of existing construction).

3.1.4 Corridors/ passage ways at height

At points where there is risk of workers falling (from over 1.5m), there should be protective guardrails that should provide adequate protection (it should be stable). The height of the guardrail should be between 1,10m – 1,20m with a guardrail in between at a height of approximate 0,65m – 0,70m.

In case the corridor / working area is above a working area where there is a risk of falling objects to workers beneath, a toe board of 0,20m in height must be placed. For working areas / corridors for height of 1,5m and below, cones or metal bars with high visibility tape should be placed.

3.1.5 Staircases

All staircases must be equipped with guardrails in all opened sites and hand rails of 1,10m. hand rails. In cases where there is an opening between the guardrail and the steps, an extra guard rail should be placed to eliminate the risk of fall.

3.1.6 Emergency exits/ escape routes

All emergency exits and escape routes to be designated should comply with the following requirements:

i. Lead to a safe open area outside the construction site,
ii. Must be opened (not locked) at all times during working hours,
iii. Equipped with appropriate signage,
iv. To be free from any obstacles (materials, machinery etc.).

3.1.7 Scaffolding and nets

To avoid any damage caused on the monastery's fabric and structure, but also to ensure that their installation does not pose danger to passers and users, Scaffolding needs to be designed by the structural engineer of the project. It is important that prior thought needs to be given to the location of scaffold foundations, where standards can and cannot go and where boarded out decks are required to enable the work to proceed with as little difficulty and risk as possible.

All temporary structures (scaffolding and nets) should be designed before the site staff begins erection and the level of design and drawing of scaffolding and temporary structures must be commensurate with the scale of the works.

3.1.8 Signage

Restricting access and warning signs are mandatory to be in place throughout the construction site as they can be a reasonable precaution to increase hazard awareness and to avoid danger, and access to dangerous locations within the monastery during construction.

3.2 Visitors' accessibility to the site and visitors' safety

The below content included in sub category 2.0, has been prepared by the assigned Architect in order to introduce all Interventions proposed for visitors accessibility to the site, taking into account visitors safety. The proposals include the walking routes proposed, the introduction of mandatory signage and balustrades to direct the Visitors use of space and limit access towards the chapel inside the monastery that will be conserved and used.

The content is based on the decision making collected during site visits and site study by the contractor team at the Monument and during the meetings and feedback given by the UNDP/AB to the consultant team. It outlines the basic interventions to safety and accessibility proposed requirements for the visitor, to be furtherly elaborated during the final report stage prior to construction stage.

3.2.1 Block A

Block A has been decided that will allow no access to the visitors. The restricted area of the upper courtyard and West entrance, will guarantee the limitation of the visitor, for accessing the Blocks' front corridor and balconies.

3.2.2 Block B

Block B has been decided that will allow no access to the visitors proposing for its current doors and windows to be at all times locked. Furthermore the restricted area of the upper courtyard and West entrance, will guarantee the limitation of the visitor, for accessing the Blocks front corridor and balconies.

3.2.3 Block C

Block C has been decided that will allow access to the visitors at its lower northern part only. The proposed timber partitioning for doors D.C.06 and D.C.24 along with the proposed metal barrier for door D.C.19 will limit the accessibility of the visitor to the southern part of Block C (lower and upper part). Additionally, the installation of balustrade to the terrace and upper courtyard will reassure the prevention of any visitor access to the upper part of Block C.

Furthermore, for visitors' safety precautions, the introduction of balustrades (entrance and cliff balustrade) will be in place as indicated in the drawings of the tender documents. Two handicap Access Ramps with 1:10 slope angle, located at the East Elevation of the Monastery, will also be constructed as per drawings of the tender documents.

3.2.4 Block D

Block D has been decided that will allow no access to the visitors. The installation of balustrade to the terrace towards the upper part of Block C will guarantee the limitation of the visitor, for accessing the Block's front corridor and interior of the cells.

3.2.5 Block E

Block E will be fully accessible to visitors as the main conserved and used part of the monastery. For access purposes the Chapel's entrance will be re-introduced as currently the entrance has an open access point, but now a constructed of iroko timber panels door will be in place. The chapel's timber and metal windows will have their broken parts replaced with a clear glass with lamination membrane to be installed within the existing frames to maintain the maximum safety possible, both for the chapel and its users, towards weather conditions and the monastery's ageing.
Measurements to be taken on site before cutting glass to avoid creating dangerous construction sites for the site workers.
Lastly a signage will be installed at the Chapels entrance for Visitors guidance (Signage D). Signage will provide historical information on what the visitor will be looking at. It will include important dates, construction details and historical evidence.

3.2.6 Block F

Block F will be fully accessible to visitors as the secondary accessible conserved and used part of the monastery. A signage will be installed at the old Chapels interior for Visitors guidance (Signage C). Signage will provide historical information on what the visitor will be looking at. It will include important dates, construction details and historical evidence.

3.2.7 Block G

Block G has been decided that will allow no access to the visitors. The restricted area of the entire upper courtyard and West entrance, will guarantee the limitation of the visitor, for accessing the Block area.

3.2.8 North, South and West Entrance

The three entrance points located on the North, South and West sides of the monastery, has been decided that will no longer be accessible to the public, for the monastery's general protection and restriction of further damages and deterioration. The blockage of the three entrances will be done via installing galvanized metal barriers. The proposed fixed gates installed at the three entrances will be comprised of welded galvanized tubes, in a way that allows visual observation, while at the same time restricting physical access.

3.2.9 Lower Courtyard and Upper Courtyard

The Upper Courtyard has been decided that will allow no access to the visitors for any use of the area, (buildings and garden area) proposing an entire blockage of its surroundings. Furthermore the area is also blocked of access from the monastery's West Entrance, to reassure limitation of the visitor, for accessing the Upper Courtyard. However, a locked gate will be located at the staircase leading to the upper courtyard, allowing access towards the rest of the monastery for maintenance purposes but limiting the visitor's access to the area.

The Lower Courtyard has been decided that will be fully accessible to visitors with the appropriate implementation of guidance for the visitor and how to use the area. The first intervention suggest placing signage's by the entry point of the courtyard (signage A), and in the middle of the courtyard (signage B). Signage will provide historical information on what the visitor will be looking at. It will include important dates, construction details and historical evidence. Furthermore the lower courtyard will be blocking access of the visitors to any point beyond its borders, via the proposed balustrades. Lastly a regular cleaning and maintaining of the lower courtyard (monthly according to the maintenance plan suggested) will reassure the safety of the site at its own but most importantly the safe use of the site at any time by any expected or unexpected visitor.

The proposed balustrades of the lower and upper courtyard though restricting physical access to the buildings and garden area, create balconies that allow visual observation of the Monastery's inaccessible areas.

4 Safeguarding techniques for Special Elements (during construction phase)

Special Elements such as the Tower Arches, Medieval Windows, Block C cooking area, and existing signage around the site, will be safeguarded during construction phase. The Contractor is obliged to strictly follow the guidelines described within the contents of the Technical Specifications and any further advice provided during construction phase by the Architect and Engineer.

Special Elements such as the Chapels Tiles and Baptistery will need to be fully protected during the entire construction phase until completion. The contractor will be advised to protect the Baptistery by using a temporary protection structure – a custom made OSB timber box of 25mm frame thickness (at least) – which will reassure the protection of the original Baptistery during construction phase within the chapel, and it will protect the Baptistery from any damages even in the case of a wall collapsing or equipment used around the special element. Furthermore, an appropriate protection thin sheet will need to be placed on the existing traditional tiles during structural works within the chapel, and prior to any conservation treatments that will be afterwards applied on the tiles themselves. The temporary sheet will need to be a 10mm thickness (at least) cardboard sheet that will protect the tiles from damages in case of any equipment material or building material falls onto the floor, including painting, stones, etc. Additionally a timber sheet can be used of 2-3mm thickness as a top layer, and a soft sheet of tarpaulin as an underneath layer, in case of more heavy equipment will need to enter the interior of the chapel during construction phase.

Special Elements such as the Block C kitchen beam will need to be carefully removed from its current location to avoid any expose to danger causing further damage on the decorative historic beam. The contractor is responsible for the accurate documentation of the special elements by means of detailed measurements, drawings and photographic records. Lastly, the special element will be safely stored within the site and the exact location will be decided later on by the client.

The above measures reassure that the Monastery's special elements will not be exposed to any danger or further damage caused by workers, visitors or working equipment used.

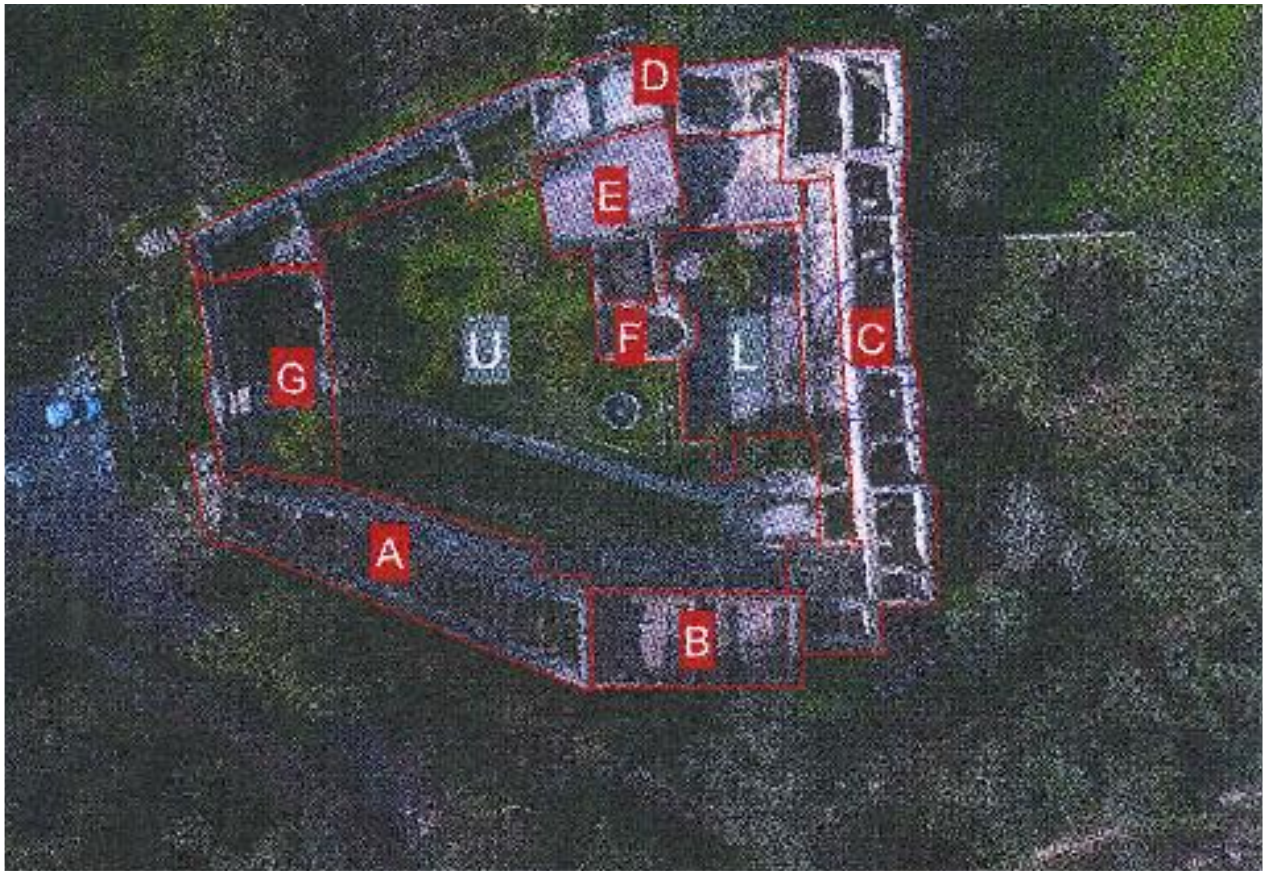
LIST OF DELIVERED DRAWINGS

A/A	Drawing Description	Scale
A-Ex 01	Topographic Survey	1:100
A-Ex 02	Plan-Level +85.650	1:100
A-Ex 03	Plan-Level +90.300	1:100
A-Ex 04	Plan-Level +95.500	1:100
A-Ex 05	Plan-Level +98.000	1:100
A-Ex 06	Roof Plan-Section Lines	1:100
A-Ex 07	Section 1-S1	1:100
A-Ex 08	Section 2-S2	1:100
A-Ex 09	Section 2-S3	1:100
A-Ex 10	Section 4-S4	1:100
A-Ex 11	Section 5-S5	1:100
A-Ex 12	Section 6-S6	1:100
A-Ex 13	Section 7-S7	1:100
A-Ex 14	Section 8-S8	1:100
A-Ex 15	Section 9-S9	1:100
A-Ex 16	Section 10-S9	1:100
A-Ex 17	Exterior Façade East-EF1	1:100
A-Ex 18	Exterior Façade East-EF2	1:100
A-Ex 19	Exterior Façade East-EF3	1:100
A-Ex 20	Exterior Façade East-EF4	1:100
A-Ex 21	Interior Façade-IF1	1:100
A-Ex 22	Interior Façade-IF2	1:100
A-Ex 23	Interior Façade-IF3	1:100
A-Ex 24	Interior Façade-IF4	1:100
A-Ex 25	Interior Façade-IF5&IF7	1:100
A-Ex 26	Interior Façade-IF6	1:100
A-Ex 27	Plan Block A +95.50	1:50
A-Ex 28	Plan Block A +98.00	1:50
A-Ex 29	Plan Block B +95.50	1:50
A-Ex 30	Plan Block B +98.00	1:50
A-Ex 31	Plan Block C +85.65	1:50
A-Ex 32	Plan Block C +90.30	1:50
A-Ex 33	Plan Block C +95.50	1:50
A-Ex 34	Plan Blocks D, E, F +85.65	1:50
A-Ex 35	Plan Blocks D,E, F +90.30	1:50
A-Ex 36	Plan Blocks D,E, F +95.50	1:50
A-Ex 37	Plan Block G +90.30	1:50
A-Ex 38	Plan Block G +95.50	1:50
A-Ex 39	Block A-Sections	1:50
A-Ex 40	Block B-Sections	1:50
A-Ex 41	Block C-Sections Part A	1:50
A-Ex 42	Block C-Sections Part B	1:50
A-Ex 43	Block D-Sections	1:50
A-Ex 44	Block E-Sections	1:50
A-Ex 45	Block F-Sections	1:50
A-Ex 46	Block G-Sections	1:50
A-Ex 47	Special Elements-SE1 - Block E-Chapel Flooring Tiles	1:20

A-Ex 48	Special Elements –SE2 Block F-Chapel Flooring Tiles	1:20
A-Ex 49	Special Elemenents-SE3 Block G-West Entrance	1:20
A-Ex 50	Special Elements-SE4 Block C-Medieval Windows	1:20
A-Ex 51	Special Elements-SE5 Block C-East Entrance	1:20
A-Ex 52	Special Elements –SE6 Block C-Medieval Window with Special Pattern	1:20
A-Ex 53	Special Elements-SE7 Block C-Cooking Area	1:20
A-Ex 54	Special Elements-SE8 Block C-Tower Arches	1:20 & 1:5
A-Ex 55	Special Elements-SE9 Block C-Kitchen Beam Block C-Floor Construction Detail	1:10 & 1:5
A-Ex 56	Special Elements-SE10 Block F-Belfry	1:20
A-Ex 57	Special Elements-SE14 Block E-Church Baptistery	1:20
A-Ex 58	Special Elements-SE12 Catholics Sahag II/ Signage Block G-Memorative Signage	1:2.5
A-Ex 59	Existing Doors Catalogue	1:50
A-Ex 60	Existing Doors Catalogue	1:50
A-Ex 61	Existing Doors Catalogue	1:50
A-Ex 62	Existing Doors Catalogue	1:50
A-Ex 63	Existing Doors Catalogue	1:50
A-Ex 64	Existing Doors Catalogue	1:50
A-Ex 65	Existing Windows Catalogue	1:50
A-Ex 66	Existing Windows Catalogue	1:50
A-Ex 67	Existing Windows Catalogue	1:50
A-Ex 68	Existing Windows Catalogue	1:50
A-Ex 69	Existing Windows Catalogue	1:50
A-Ex 70	Existing Windows Catalogue	1:50
A-Ex 71	Existing Windows Catalogue	1:50
A-Ex 72	Existing Windows Catalogue	1:50
A-Ex 73	Plan-Block A +95.50-Condition Assessment	1:50
A-Ex 74	Plan-Block B +95.50-Condition Assessment	1:50
A-Ex 75	Plan-Block C +85.65-Condition Assessment	1:50
A-Ex 76	Plan-Block C +90.30-Condition Assessment	1:50
A-Ex 77	Plan-Block D,E,F +85.65-Condition Assessment	1:50
A-Ex 78	Plan-Block D,E,F +90.30-Condition Assessment	1:50
A-Ex 79	Plan-Block D,E,F +95.50-Condition Assessment	1:50
A-Ex 80	Plan-Block G +90.30-Condition Assessment	1:50
A-Ex 81	Condition Assessment of Block A	1:50
A-Ex 82	Condition Assessment of Block B	1:50
A-Ex 83	Condition Assessment of Block C	1:50
A-Ex 84	Condition Assessment of Block C	1:50

A-Ex 85	Condition Assessment of Block D	1:50
A-Ex 86	Condition Assessment of Block E	1:50
A-Ex 87	Condition Assessment of Block F	1:50
A-Ex 88	Condition Assessment of Block G	1:50
A-Ex 89	Exterior Façade East-EF01-Condition Assessment	1:100
A-Ex 90	Exterior Façade South-EF02-Condition Assessment	1:100
A-Ex 91	Exterior Façade West-EF03-Condition Assessment	1:100
A-Ex 92	Exterior Façade Soouth-EF04-Condition Assessment	1:100
A-Ex 93	Interior Façade-IF01-Condition Assessment	1:100
A-Ex 94	Interior Façade-IF02-Condition Assessment	1:100
A-Ex 95	Interior Façade-IF03-Condition Assessment	1:100
A-Ex 96	Interior Façade-IF04-Condition Assessment	1:100
A-Ex 97	Interior Façade-IF05&IF07-Condition Assessment	1:100
A-Ex 98	Interior Façade-IF06-Condition Assessment	1:100
A-Pr 01	Visitors Accessibility Level +85.65	1:200
A-Pr 01B	Visitors Accessibility Level +98.00	1:200
A-Pr 02	Proposed Interventions-Plan Level +85.65	1:100
A-Pr 03	Proposed Interventions-Plan Level +90.30	1:100
A-Pr 04	Proposed Interventions-Plan Level +95.50	1:100
A-Pr 05	Proposed Interventions-Plan Level +98.00	1:100
A-Pr 06	Proposed Interventions-Exterior Façade East-EF01	1:100
A-Pr 07	Proposed Interventions-Exterior Façade South-EF02	1:100
A-Pr 08	Proposed Interventions-Exterior Façade West-EF03	1:100
A-Pr 09	Proposed Interventions-Exterior Façade North-EF04	1:100
A-Pr 10	Proposed Interventions-Block A-Sections	1:50
A-Pr 10B	Proposed Interventions-Block B-Sections	1:50
A-Pr 11	Proposed Interventions-Block C-Sections Part A	1:50
A-Pr 12	Proposed Interventions-Block C-Sections Part B	1:50
A-Pr 13	Proposed Interventions-Block D-Sections	1:50
A-Pr 14	Proposed Interventions-Block E-Church Sections	1:50
A-Pr 15	Proposed Interventions-Block F-Sections	1:50
A-Pr 16	Proposed Interventions-Block G-Sections	1:50
A-Pr 17	Proposed Interventions-Block E-Timber Chapel Door	1:20
A-Pr 18	Proposed Interventions-Block E-Restoration of the chapel windows	1:20
A-Pr 19	Proposed Interventions-Block E-Chapel Flooring Tiles	1:20
A-Pr 20	Proposed Interventions-Block F Flooring Tiles	1:20
A-Pr 21	Proposed Interventions-Block F-Wrought Iron Gate of the Narthex	1:20
A-Pr 22	Proposed Interventions-West, North, South Entrance & Doors Partitions	1:20
A-Pr 23	Proposed Interventions-Balustrade Detail	1:20 & 1:50
A-Pr 24	Proposed Interventions-East Entrance Disabled Access Ramp Detail	1:20 & 1:5
A-Pr 25	Proposed Interventions-East Entrance Disabled Access Ramp to Courtyard Detail	1:20 & 1:5
A-Pr 26	Proposed Interventions-Block A-Drainage Plan	1:50
A-Pr 27	Proposed Interventions-Block A-Drainage Section A-A’	1:20
A-Pr 28	Proposed Interventions-Block A-Drainage Section B-B’	1:20
A-Pr 29	Proposed Interventions-Block A-Drainage Section C-C’	1:20

A-Pr 30	Proposed Interventions-Block A-Drainage Section D-D’	1:20
A-Pr 31	Proposed Interventions-Block A-Drainage Section E-E’	1:20
A-Pr 32	Proposed Interventions-Block C-Drainage Plan	1:50
A-Pr 33	Proposed Interventions-Block C-Drainage Section A-A’	1:20
A-Pr 34	Proposed Interventions-Block C-Drainage Section B-B’	1:20
A-Pr 35	Proposed Interventions-Block C-Drainage Section C-C’	1:20
A-Pr 36	Proposed Interventions-Reconstruction of Baptistery	1:20
A-Pr 37	Proposed Interventions-Proposed Perimeter Drainage System Detail	1:20
A-Pr 38	Proposed Interventions-Signage General Details	1:20
S-Pr 01	Consolidation and repair of masonry by means of grout injection	1:20
S-Pr 02	Installation of steel tie rods	1:20
S-Pr 03	Replacement of damaged timber beams	1:20
S-Pr 04	Steel Truss Frame Structure	1:100 & 1:20
S-Pr 05	Steel Truss Frame Structure – Details	1:20
S-Pr 06	Steel Truss Frame Structure – Details	1:20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