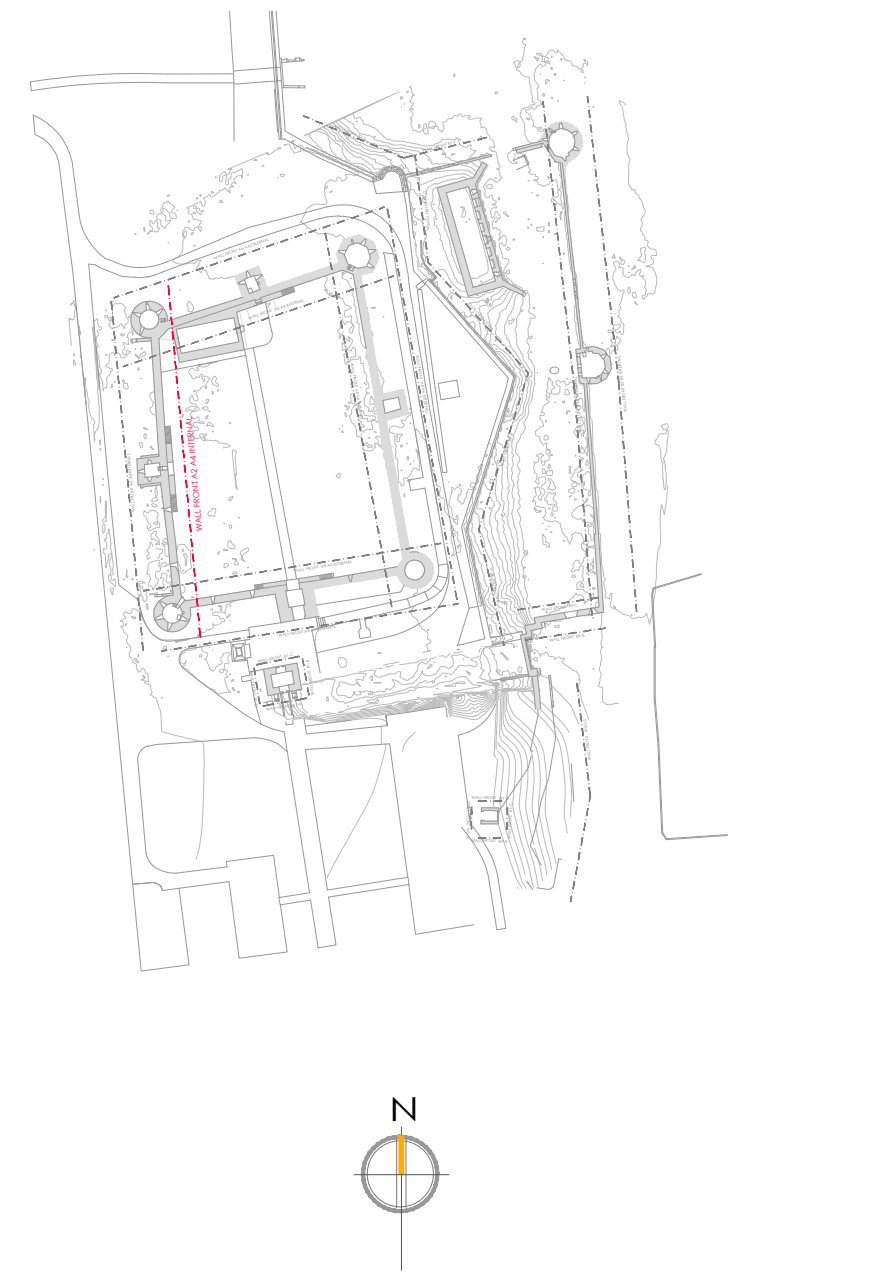
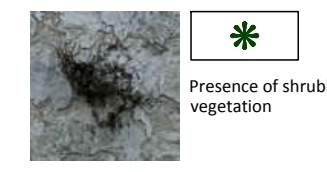
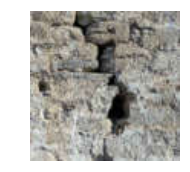
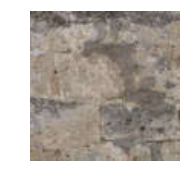
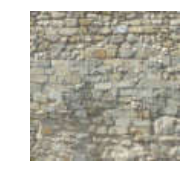
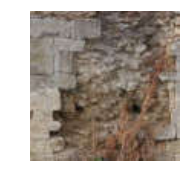
Tower A2: reconstruction of the roof with a structure formed by wooden beams and covered with wooden tiles
Regularization of the top of the tower masonry for the construction of roofs
Reconstruction of masonry battlements covered with terracotta tiles, between tower A2 and tower A3
Tower A3: replacement of the roof tiles with a cover made in wooden tiles supported by a new structure formed by wooden beams
Tower A4: reconstruction of the roof with a structure formed by wooden beams and covered with wooden tiles
Regularization of the top of the tower masonry for the construction of roofs



ALTERATIONS	DESCRIPTION OF INTERVENTIONS	CODES
PREPARATION OF THE BUILDING SITE These interventions (n.1 - n.4) should be carried out as preliminary phases of the intervention sequences planned for all alterations.	1 - Rental of tubular scaffolding with prefabricated frames, complete on site (for straight façades), up to a height of 20 m, measured on the effective external surface of the scaffolding, including transport, assembly and disassembly, excluded: the preparation of work plans and their subjects, any garrison works, the municipal tax for the occupation of spaces and public areas (plateatic): for the first month (or fraction) extended to the whole perimeter overlapping also to the stretches of scaffolding already calculated with the structural interventions. (1.2.5a) 2 - Hire of work table or sub-slab, up to a height of 20 m accompanied by a regular foot clip and parapet, including preparation and dismantling, measured in horizontal projection: up to 30 days. (1.2.6a) 3 - protection of facade bridge, up to a height of 20 m applied on existing scaffolding, with plastic sheeting or nets, excluding technical relationship, including attachments, preparation, dismantling, and removal of materials. (1.2.7) 4 - Sandblasting of all historic wall surfaces using the Rotec, IBIX or JOS system (with low-pressure rotary vortex process, suitable aggregates and water working pressure, standard nozzles 10 16 mm, inert granules from 100 to 200 Micron, to be tested on construction site and approved by work management). Manual completion with scalpels, scrapers, brushes and spatulas in order to obtain smooth surfaces without affecting the original surface. All this includes sealing, scaffoldings up to 3 m high, final cleaning to give the complete work to perfection. Completion through removal of incoherent surface deposits (dust, soil, etc.) by means of vacuum cleaners and brushes. Coherent surface deposits, encrustations, concretions, altered fixatives should be removed through the application of compresses soaked in an inorganic salts or ammonium carbonate saturated solution; deposits solubilized will be cleaned through brushes, scalpels, specils.	1.2.5a 1.2.6a 1.2.7 1C.25.200.0225.a 1C.25.100.0470
▨ Wall with intense biological patina	1 - Removal of biological patina by application of biocide on surfaces | the removal should be done by using a biocide based on quaternary salts ammonium, broad spectrum, which does not form films or chromatic alterations on stone surfaces. Once the products have been laid, it will be necessary to wait a few days (according to the product data sheet) for them to take effect and eliminate the organisms. The processing residues and all coherent and incoherent deposits must be removed manually. The operation must not damage the stone surfaces. NB: this operation must be carried out after scaffolding installation and before cleaning	1C.25.100.0310.b
 ✱ Presence of shrubby vegetation	1 - Removal of shrubby vegetation by application of biocide | the removal should be done by using a biocide based on quaternary salts ammonium, broad spectrum, which does not form films or chromatic alterations on stone surfaces. Once the products have been laid, it will be necessary to wait a few days (according to the product data sheet) for them to take effect and eliminate the plants. The processing residues and all coherent and incoherent deposits must be removed manually. The operation must not damage the stone surfaces. NB: this operation must be carried out after scaffolding installation and before cleaning	1C.25.100.0320.b
▨ Loss of original surface, leading to smoothed shapes	Tangential sandblasting (with JOS or IBIX type system)operating with compressed air, with adjustable operating pressure, variable nozzle mounted on pen or gun. Sandblaster and abrasive of selected type and grain size. Including set-up, adjustment, confinement and sampling charges, all the equipment necessary for the correct application of the precision aero-abrasive system. On any surface even in masonry. Completion through removal of incoherent surface deposits (dust, soil, etc.) by means of vacuum cleaners and brushes. Estimated on 15% of stone surfaces, only when and where necessary: - Consolidation of stone artefacts in the presence of diffuse phenomena of decohesion, by impregnation up to waste with ethyl silicate applied with brushes, syringes, pipettes. Operation to be performed following or during the cleaning operations on limestones. - Completion through injections of lime fluid mortar: re-establishment of cohesion in cases of mortar disintegration of lodging of stone masonry in consequence of the creation of continuity solutions between the textural elements, through injections of lime fluid mortar; including related charges the execution of the holes and the eventual preventive sealing of the holes clefts	P.08
▤ Mortar joint leakage	Tangential sandblasting (with JOS or IBIX type system) operating with compressed air, with adjustable operating pressure, variable nozzle mounted on pen or gun. Sandblaster and abrasive of selected type and grain size. Including set-up, adjustment, confinement and sampling charges, all the equipment necessary for the correct application of the precision aero-abrasive system. On any surface even in masonry. Completion through removal of incoherent surface deposits (dust, soil, etc.) by means of vacuum cleaners and brushes. Estimated on 15% of stone surfaces, only when and where necessary: - Consolidation of stone artefacts in the presence of diffuse phenomena of decohesion, by impregnation up to waste with ethyl silicate applied with brushes, syringes, pipettes. Operation to be performed following or during the cleaning operations on limestones. - Completion through injections of lime fluid mortar: re-establishment of cohesion in cases of mortar disintegration of lodging of stone masonry in consequence of the creation of continuity solutions between the textural elements, through injections of lime fluid mortar; including related charges the execution of the holes and the eventual preventive sealing of the holes clefts Restoration of the joints: the stripping of old mortars (if irrecoverable) with the burden of safeguarding the sections where conservative intervention is possible; the elimination of all cement mortars; grouting of the connections and joints with lime mortar and suitable aggregates, including the charges relating to the tests for the composition of mortars suitable for coloring and grain size, its surface treatment, the cleaning of any residues from the surrounding surfaces. Excluding the re-establishment of the cohesion of preserved mortars. Including the depth layer with hydraulic mortar and filling material (for a leveling layer) and mortar for finishing; to be evaluated on the surface actually treated: on a limestone facing	P.09
▨ Fragmentation and breakage of the stone material: the complete or partial breaking up of a stone, into portions of variable dimensions that are irregular in form, thickness and volume	Tangential sandblasting (with JOS or IBIX type system) operating with compressed air, with adjustable operating pressure, variable nozzle mounted on pen or gun. Sandblaster and abrasive of selected type and grain size. Including set-up, adjustment, confinement and sampling charges, all the equipment necessary for the correct application of the precision aero-abrasive system. On any surface even in masonry. Completion through removal of incoherent surface deposits (dust, soil, etc.) by means of vacuum cleaners and brushes. Estimated on 15% of stone surfaces, only when and where necessary: - Consolidation of stone artefacts in the presence of diffuse phenomena of decohesion, by impregnation up to waste with ethyl silicate applied with brushes, syringes, pipettes. Operation to be performed following or during the cleaning operations on limestones. - Completion through injections of lime fluid mortar: re-establishment of cohesion in cases of mortar disintegration of lodging of stone masonry in consequence of the creation of continuity solutions between the textural elements, through injections of lime fluid mortar; including related charges the execution of the holes and the eventual preventive sealing of the holes clefts Reconstruction of the wall facing: reconstruction of portions of lost or unrecoverable masonry walls, carried out after consolidation of the residual mortars with subsequent reconstruction of the missing part with the use of materials and techniques compliant with the original ones and adequate bonding to the core behind; including charges relating to the supply of the material to be integrated and the cleaning of any residues from the surrounding surfaces. Excluding the restoration of the cohesion of the mortars behind and the styling of the joints; calculated per square meter for a maximum thickness of 25 cm, with limestone elements with antiquing treatment	P.10
🟥 Alteration of stone this symbol indicates the presence of loss of original surface, fragmentation and mortar joint leakage	Tangential sandblasting (with JOS or IBIX type system) operating with compressed air, with adjustable operating pressure, variable nozzle mounted on pen or gun. Sandblaster and abrasive of selected type and grain size. Including set-up, adjustment, confinement and sampling charges, all the equipment necessary for the correct application of the precision aero-abrasive system. On any surface even in masonry. Completion through removal of incoherent surface deposits (dust, soil, etc.) by means of vacuum cleaners and brushes. Estimated on 15% of stone surfaces, only when and where necessary: - Consolidation of stone artefacts in the presence of diffuse phenomena of decohesion, by impregnation up to waste with ethyl silicate applied with brushes, syringes, pipettes. Operation to be performed following or during the cleaning operations on limestones. - Completion through injections of lime fluid mortar: re-establishment of cohesion in cases of mortar disintegration of lodging of stone masonry in consequence of the creation of continuity solutions between the textural elements, through injections of lime fluid mortar; including the execution of the holes and the eventual preventive sealing of the holes clefts Restoration of the joints: the stripping of old mortars (if irrecoverable) with the burden of safeguarding the sections where conservative intervention is possible; the elimination of all cement mortars; grouting of the connections and joints with lime mortar and suitable aggregates, including the charges relating to the tests for the composition of mortars suitable for coloring and grain size, its surface treatment, the cleaning of any residues from the surrounding surfaces. Excluding the re-establishment of the cohesion of preserved mortars. Including the depth layer with hydraulic mortar and filling material (for a leveling layer) and mortar for finishing; to be evaluated on the surface actually treated: on a limestone facing Reconstruction of the wall facing and battlements by analogy: reconstruction of portions of lost or unrecoverable masonry walls, carried out after consolidation of the residual mortars with subsequent reconstruction of the missing part with the use of materials and techniques compliant with the original ones and adequate bonding to the core behind; including charges relating to the supply of the material to be integrated and the cleaning of any residues from the surrounding surfaces. Excluding the restoration of the cohesion of the mortars behind and the styling of the joints; calculated per square meter for a maximum thickness of 25 cm, with limestone elements with antiquing treatment	P.11
STRUCTURAL FAILURES Main items:		
⟋ Crack: Minor crack with a width of about 0.1 mm	Consolidation of structural cracks with preventive sealing of sublevel lesions with hydraulic lime mortar and aggregates, with insertion of the pipes necessary for injections and subsequent infiltration in depth of pre-mixed hydraulic mortars (superfluid grout, volumetrically stable, packed with superfluid fillerized hydraulic binder, salt-resistant, cement-free, composed of lime and Eco-Pozzolana, ultra-fine natural sands and special additives such as Mape-Antique I from MAPEI S.p.A. or similar), carried out gradually proceeding from the bottom to the top until saturation of the continuity solutions; including final grouting with finishing ime mortars.	1C.25.200.0130
 ⫽ Deep crack: Crack that crosses completely the stone piece	Reparation of gaps affecting the core wall, carried out through integration with materials similar to the original ones | The intervention surfaces of both the core and the face must be suitable for hosting the restoration. They must be carefully cleaned with brushes and vacuum cleaners, any residue of biocide treatment, to be carried out where necessary by means of quaternary ammonium salts applied by spray or brush, must be eliminated. The core must be restored by reintegrating it with limestone and hydraulic mortars without cement. The cracks in the core must be filled with injections of pre-mixed hydraulic mortars (superfluid grout, volumetrically stable, packed with superfluid fillerized hydraulic binder, salt-resistant, cement-free, composed of lime and Eco-Pozzolana, ultra-fine natural sands and special additives such as Mape-Antique I from MAPEI S.p.A. or similar), carried out gradually proceeding from the bottom to the top until saturation of the continuity solutions. The external stone facing must be restored using recycled stones from the construction site or new stones like to the existing ones. The installation must be done with hydraulic lime mortars suitably tested on site, paying close attention to the connection with the existing facing. All joints must be grouted with hydraulic lime finishing mortar without cement.	1C.25.200.0430 1C.06.720.0040
 ⟋ Filled crack	Resumption of the drawing-up of the crack through the scrapping of the old cement mortars, then grouting with lime mortar and suitable aggregates. All restoration mortars must be tested to define their composition (suitable, for colouring and grading, to the historical one). All joints must be grouted with hydraulic lime finishing mortar without cement. All surfaces must be well cleaned of any residues.	1C.25.200.0405.b
▨ Detachment of the facing stones	The intervention surfaces must be suitable for hosting the restoration. They must be carefully cleaned with brushes and vacuum cleaners, any residue of biocide treatment, to be carried out where necessary by means of quaternary ammonium salts applied by spray or brush, must be eliminated. The cracks in the core must be filled with injections of pre-mixed hydraulic mortars (superfluid grout, volumetrically stable, packed with superfluid fillerized hydraulic binder, salt-resistant, cement-free, composed of lime and Eco-Pozzolana, ultra-fine natural sands and special additives such as Mape-Antique I from MAPEI S.p.A. or similar), carried out gradually proceeding from the bottom to the top until saturation of the continuity solutions. The external stone facing must be restored using recycled stones from the construction site or new stones like to the existing ones. All unstable stones must be removed, cleaned, and replaced. The installation must be done with hydraulic lime mortars suitably tested on site, paying close attention to the connection with the existing facing. All joints must be grouted with hydraulic lime finishing mortar without cement.	1C.25.200.0430 1C.06.720.0040
 ▤ Swelling	The intervention surfaces must be suitable for hosting the restoration. They must be carefully cleaned with brushes and vacuum cleaners, any residue of biocide treatment, to be carried out where necessary by means of quaternary ammonium salts applied by spray or brush, must be eliminated. It will be necessary to guarantee again the adhesion between the swollen wall face and the core behind through filling with injections of pre-mixed hydraulic mortars (superfluid grout, volumetrically stable, packed with superfluid fillerized hydraulic binder, salt-resistant, cement-free, composed of lime and Eco-Pozzolana, ultra-fine natural sands and special additives such as Mape-Antique I from MAPEI S.p.A. or similar), carried out gradually proceeding from the bottom to the top until saturation of the continuity solutions. Restoration of the joints: the stripping of old mortars (if irrecoverable) with the burden of safeguarding the sections where conservative intervention is possible; the elimination of all cement mortars; grouting of the connections and joints with lime mortar and suitable aggregates, including the charges relating to the tests for the composition of mortars suitable for coloring and grain size, its surface treatment, the cleaning of any residues from the surrounding surfaces. Excluding the re-establishment of the cohesion of preserved mortars. Including the depth layer with hydraulic mortar and filling material (for a leveling layer) and mortar for finishing; to be evaluated on the surface actually treated: on a limestone facing	1C.25.200.0430 1C.25.200.0405.b
 ▥ Collapse	The intervention surfaces of both the core and the face must be suitable for hosting the restoration. They must be carefully cleaned with brushes and vacuum cleaners (removing all incosistent parts, both mortars and stones), any residue of biocide treatment, to be carried out where necessary. The core must be restored by reintegrating it with limestone and hydraulic mortars without cement. The cracks in the core must be filled with injections of pre-mixed hydraulic mortars (superfluid grout, volumetrically stable, packed with superfluid fillerized hydraulic binder, salt-resistant, cement-free, composed of lime and Eco-Pozzolana, ultra-fine natural sands and special additives such as Mape-Antique I from MAPEI S.p.A. or similar), carried out gradually proceeding from the bottom to the top until saturation of the continuity solutions. The external stone facing must be restored with "scuci-cuci" technique (deep and superficial), in small successive sections, using recycled stones from the construction site or new stones like to the existing ones. The installation must be done with hydraulic lime mortars suitably tested on site, paying close attention to the connection with the existing facing. All joints must be grouted with hydraulic lime finishing mortar without cement, responding to the characteristics of the original.	1.5.4.6.a 1C.06.720.0040 1.4.3.2.a 1C.06.740.0050
RECENT INTERVENTIONS Main items:		
▨ Cementitious patches	1a - Remaking of the recent joints in case of recent restoration on historical masonry: resumption of the styling through the scrapping of the old mortars (if irretrievable) with the burden of safeguarding the sections in which conservation is possible, grouting of the connectors with lime mortar and suitable aggregates, including testing fees for the composition of mortars suitable for colouring and granulometry, surface processing of the same, cleaning of any residues from the surrounding surfaces, excluding the restoration of the cohesion of preserved mortars, with a depth layer with hydraulic mortar and any filling material (for a levelling layer); to be assessed on the surface actually treated; do not use cement mortars but only hydraulic mortars.	1C.25.200.0405.b
▨ Recent masonry	1b - Antique patina on recent joints in case of recent masonry: limewashing on all the recent walls inside and outside (lime, hydraulic lime, bricks, stones), vertical and horizontal, in environments of any size, with liquid lime mortars, maximum thickness 2 mm.	1C.07.760.0010
▩ Battlements tiles	Where the marseillaise tiles are superimposed on the original tiles | the recent tiles and the bedding cement mortar must be gently removed, taking care not to damage the historical materials, with the help of chisels and hammers. The historical tiles below must be carefully cleaned removing all deposits and traces of mortar. Then they must be restored (consolidating with ethyl silicate applied by brush only where necessary, grouting and styling the micro-cracks with lime mortar and brick dust) and, where missing, reintegrated with new terracotta tiles installed with lime mortar. Where there are no historical tiles, the marseillaise tiles must be removed and substitued with terracotta tiles.	1C.01.060.0010.a 1C.25.200.0310.b 1C.06.070.0150 P.15
▩ Roof tiles	Replacement of the marseillaisis tiles of the roofing and supply and installation of a wooden shingle covering, of suitable essence, size and thickness, suitably treated, shaped and laid according to the particular geometry of the roof of the towers. All inclusive, nothing excluded to give the work complete and executed in accordance with the rules of good technique; this intervention does not provide for preliminary sandblasting.	1C.01.060.0010.a P.02
▨ Layer of cement plaster	1 - Peeling of internal or external plaster, of any type (both rustic and civil), to be done before sandblasting. Including work plans, humidification, peeling to the top of the masonry; final brushing, washing and cleaning of the scraped surface; handling of rubble within the yard; loading and transport to storage facilities, recovery or landfill. Excluding disposal charges. 2 - Resumption of the stylizing of the joints through the scrapping of the old mortars (if irrecoverable) with the burden of safeguarding the sections where conservation is possible, grouting of the joints with lime mortar and suitable aggregates, including testing fees for the composition of mortars suitable for colouring and grading, surface processing, cleaning of any residues from surrounding surfaces, excluding the restoration of cohesion of preserved mortars, with a depth layer with hydraulic mortar and possible filling material (for a levelling layer); to be evaluated on the surface actually treated; do not use cement mortars but only hydraulic mortars.	1C.01.090.0020.b 1C.25.200.0405.b
▤ Not detectable		

GENERAL INSTRUCTIONS

1 - The mappings are indicative of the main decay phenomena present on the surfaces. These surfaces indicate a realistic percentage of the area to be treated. **The price of the restoration works is however fixed at a flat rate**. After the installation of the scaffolding and before starting the restoration works, the contractor must carry out a survey of all the surfaces to verify and update the mappings.

2 - **All the processes, all the materials and all the mortars must be tested on site**, before being used, and submitted for approval by the works manager and UNDP site manager.

3 - It is strictly forbidden to use cementitious materials or materials based on cement or with small traces of cement.

4 - The contractor must update the BIM model with all the data relating to the state of conservation and the work carried out, in order to deliver to the contracting authority an "as built" final status.

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European Union Confidence Building Measures Programme
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CLIENT: European Union Delegation to Moldova through its operational contractor UNDP

Technical Expertise and develop Detailed Technical Design for
CONSERVATION AND RESTORATION WORKS OF BENDER FORTRESS (Phase I)

DETAILED TECHNICAL DESIGN

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	DATE	REVISION	FILE NAME
C			
B			
A			
-	07-2020	first emission	C226_PER_008.dwg

TITLE:
RESTORATION INTERVENTIONS
Internal Elevation \| Towers A4-A2 wall front

ASSIGN. CODE	PRATICA	PARTE	DISC. PROG.	NUMERO	REV.
C226	-	P	ER	008	-

REPRESENTATION SCALE: 1:50

INTERNAL CODE: C226_PPR_001 in Preliminary project

EXPERT STAMP AND SIGNATURE:

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United Nations Development Programme

UNDP
Empowered lives.
Resilient nations.