NICOSIA WALLS IN BUFFER ZONE - COLLAPSED PARTS

DESCRIPTION OF WORKS

DESCRIPTION AND METHOD OF WORKS FOR BUILDING THE WALL

1) Remove all the collapsed parts and clean the slope from roots. Sort out the material and save ashlar stones and rubble stones as much as possible and clean for reuse.

2) Excavate the bottom of the fosse and expose the existing base of the wall up to a depth of 1.00m. Its thickness and condition should then be assessed, and further instructions are to be provided. After repairs of the existing foundations have finished the excavation should be backfilled and compacted in courses not more than 25cm final thickness and

3) The lower and first part of the wall should be built with a thickness of 80cm, consisting of 60cm rubble wall and 20cm ashlar facing stones. At least every 1.00m the ashlar stone should penetrate 20cm into the rubble-built wall to provide connection. The ashlars should follow the same pattern at the façade. The mortar to be used should be made of hydraulic lime and sand. Specifications for the mortar are provided in a following paragraph.

4) The wall should be built course by course and the soil backfill shall follow these courses. This means that one or two courses of wall, approximately 20cm high each, are built and the soil is filled and compacted. Since the wall will be freshly built and the compaction will induce pressures, the wall should be supported. The supports can be made of horizontal beams with a section of 6''X3'', the 6'' laid on the wall, and then a wooden buttress with a section of 3''X6'' at a 30/60º angle should be placed. Buttresses should be provided every 1.00 to 1.20m along the wall. At their base, on the fosse, wooden plates should be provided and anchored using steel temporary anchors, made of reinforcement steel B500C bars of a 12mm diameter adequately nailed into the soil and bent on the wall plate.

5) The backfill should be made of soil having similar granulometry to the existing soil. This means that the sand and gravel should not be more than 50% with the rest being silt and clay. Actually, decreasing slightly, the percentage of sand would be beneficial, i.e. using a proportion of 40% sand and 60% silt+clay.

6) After the completion of the first part (with the 80º slope) the supports will be placed while realizing the upper part, according to the drawings and remain in place for at least 1 month after the completion of the upper part

7) Similar procedure for building the wall should be followed for the upper part with the 50º slope. At a distance of approximately 1.00m the soil is excavated to form a trench 50cm wide and 50cm deep. A rubble wall 50cm thick is built into the trench and extended up to the bottom of the sloping wall. The wall of the second part is built in the same manner as the first part but at a slope of 50º and at heights of 20cm, the soil is placed and compacted.

This continues until the first intermediate wall and section is filled. Then at another distance of 1.00 to 1.20m, which most probably will be close to the parapet, another trench is created, and similar procedure is followed up to completing the second part.

8) During the procedure described above, it is important to provide appropriate drainage for the water that may penetrate the structure. It would be wise to repair the pavement and the road's drainage system to prevent the percolation of water, but nevertheless a drainage system has to be provided so that water can filter out and similar conditions are avoided or limited in the future. To do this at every 1 or 2 courses of building - backfilling, small trenches 15- 20cm wide and 20cm deep, filled with gravel and covered with geotextile, repeated every 150cm should be created, perpendicular to the supporting wall. At the supporting wall 2 copper tubes of 22mm diameter type Y (thickness 1.2mm) R220 according to EN1057, should be placed at the bottom of this trench to allow the water to run out of the backfill. These tubes should be placed at ashlar joint locations and be cut so that they don't extend outwards.

9) The process described above will have to be modified at the ends/edges of the collapsed area. The wall at the ends has an irregular stepped layout and appears to have also detached from the backfill, especially at the upper part. The adjacent parts should be dismantled up to the point that detachment between wall and soil ends. This may increase the width of the work from 20-22m to around 26m. The necessary width will be determined on site after the exposure has taken place.

10) Along the ends/edges the lower part should be built and interconnected to the adjacent parts of the wall by keying the new built rubble and ashlar stones with the existing ones. For the upper part similar stone stitching will be implemented and additionally vertical short rubble walls can be built with a thickness of 50cm and a height of 50cm below the top wall.

11) Machinery can be used for excavations at the bottom and for material transfer, but it seems difficult to use machinery for excavating at the slopes or for compaction. Excavations at the slopes would probably be carried out manually. For compaction only, small rammers or compacting plates can be used.

12) The presence of an archaeologist during the works, for the phase of dismantling and cleaning in case there are findings to be recorded and for the phase of the works for recording the implementation.

13) The contactor should follow the existing layout of the facing ashlars and their joints, while building the collapsed area, trying to smoothly bridge the two ends of the collapsed area. Strings should be attached to configure the sizes of the stones and the lines of the ashlars horizontally. Vertically the joints should be interlocked as implemented for the existing wall.

Similar procedure should be followed for the rubble wall at the back. The rubble should be built into courses and not randomly built and vertical joints along the height should again be interlocked. Special care to be taken for connecting the rubble and the ashlar layer as mentioned above in para. 3)

14) Samples of building the rubble wall and the ashlar wall, for the procedure and appearance, as well as samples of the building and joint mortars should be prepared for approval before the implementation. Use of the existing stone material is important and compulsory. Use of new stone material can be used for the rubble wall, but for the ashlar wall is important to use the existing material and use new stones only if necessary. Where new ashlars need to be used then they should be treated so that the match the existing structure as much as possible. A sample should be prepared for this purpose also.

Above methodology is also shown on the attached drawings and details.

SPECIFICATIONS FOR MATERIALS – MORTAR

Use a commercial mortar with aggregates like Limepor or Mapei Antique or equivalent. This is a hydraulic lime-based mortar that can be used for building new or repair existing masonry walls and joint filling. This mortar already contains pre-mixed aggregate and it only has to be mixed with water following the instructions in the technical sheet. Its salt content will therefore remain below 100 µs cm^{-1}.

In view of the above technical specifications, it appears that the mortar is compatible with the masonry materials, such that its use is therefore recommended.

Bedding Mortar Mix Proportions: Mix by Volume.
Mixing Procedures: Measure materials by volume or equivalent weight, following precisely the recommendations on the technical sheet of the material. Do not apply or mix mortar on outside surfaces with standing water or outside during rain. Mortar mixing should be done only in the shade; Cover mortar in hot weather to reduce evaporation.

Mix ingredients in clean mechanical batcher for 5-10 minutes. Measure the materials by volume or an equivalent weight, in dry conditions. Do not measure by shovel, use known measure.
Consistently and accurately measure materials for each batch.
Mix for at least five minutes in a mechanical batch mixer or mortar box. Mix trowel workable consistency for unit masonry setting and resetting. Thoroughly mix materials together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix which will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 1 to 2 hours. Add remaining water in small portions until mortar of desired consistency is reached. Let mortar sit for 1 hour prior to use to allow for initial shrinkage.

Remix mortar to workable consistency. Use mortar within 1.5 hours of initial remixing. Discard mortar that has not been used within two hours after mixing; do not re-temper at mixer. Dispose of waste mortar and cleaning water in approved manner; do not contaminate the site, adjoining property, or waste to sewers.

Colored Mortar: Produce mortar of required color by use of selected ingredients. Do not adjust proportions without the Engineer's approval.

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

Match original color and texture for each kind of mortar and masonry work. Match to inner mortar color which has been protected from weathering and soiling, not face color.
Do not use admixtures of any kind in the mortar, unless otherwise indicated.

Field Samples: Prior to the start of general masonry restoration, prepare samples on the structure where directed by Engineer. Obtain Engineer's approval of visual qualities before proceeding with the work. Retain acceptable panels in undisturbed condition, designated suitable during construction as a standard for judging completed work

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

No stone work will be performed when the air temperature is 10ºC and falling or when stone surface temperature is 10ºC or below. Do mix or apply in temperatures exceeding 35ºC or expected to be or get higher. In warm temperatures over 25 degrees apply in the afternoon and cover with damp cloth and keep moist.

BUILDING OF STONES
Use the existing stones from the collapsed or dismantled areas. Where additional stones are required use old and sound stones from other areas in the Nicosia that are from the same origin. If not found, then obtain from the Gerollakos/Alaykoy quarry.

Appropriate stone material should match the physical and mechanical properties as much as possible to the original material, such as mineralogical composition, color, density, porosity, hydraulic and mechanical characteristics, compressive and tensile strength, absorption.

With regard to the mechanical properties, it is especially worth noting that a more appropriate stone material will present strengths and modulus of elasticity that is equal or slightly less than that of the original material.

The new material, from Nicosia or quarry, should be visually inspected and approved by the Engineer, who will judge if tests should also be carried out to check any of the abovementioned properties.

EXECUTION

1) Clean the area from loose materials and debris, i.e. mortar, soil, sand, small stone pieces etc. Clear the bottom to find the lower course. Check if the base found is sound or there are eroded stones that must be replaced and also cleaned. Report the findings and the method to the Engineer for approval. Check the existing depth and thickness of the base and report to the Engineer to receive further instructions

2) Pre-wet adjacent surfaces with clean low salt potable water. Use appropriate string lines, attached with nails to the joints, to form the surfaces that should be followed and obtain approval by the Engineer. After removing the strings repair the joints affected

3) Set stone in an evenly filled bed of mortar, with full mortar coverage on horizontal and vertical joints. Maximum tolerances from plumb and level of new work, not to exceed variation from plumb and level of adjacent existing work. Match existing placement, pattern and location.

4) For the Ashlars construct uniform joints. Shove vertical joints tight. Adjust stone units to final position while mortar is soft and plastic. Set stone with joints tooled back 1cm. Point remaining depth as the rest of the stone is pointed. For the rubble wall follow the existing pattern, avoid the use of small stones and large quantities of mortar. Rubble courses follow the ashlar courses since both form the supporting wall but should be interconnected as above mentioned in the description paragraphs

5) Keep mortar and stone damp until mortar is cured and not less than 3 days.

6) Ashlar stones should be cleaned, before the mortar hardens, to remove excess mortar, grout and adhesives from the face of the masonry. Clean stone only with bristle fiber brushes and water. No acids or strong detergents to be used.

WOOD

Wooden structures are used only as temporary support of the wall during the stages of laying and compacting soil. As wall height increases additional wall plates and buttresses are added which should be connected together with the use of horizontal elements of the same section. These structures are temporary since after the wall's materials mature and according to the above-mentioned description of work, they will be removed at a later stage. Any detected defect on the wall's surface after removing the buttresses should be repaired with the same mortar as mentioned in previous paragraphs.

Use conifer origin wooden elements of high quality and strength equivalent to C18-EN338. Connect the elements by using appropriate screws, usual or coach screws or even bolts, to have good and adequate connections. Wooden material, connecting devices and spacing them, should follow the requirements of EN1995.

TIME SCHEDULE OF WORKS

- Time to complete shall not be more than 18 calendar weeks from site handover.
- Mobilisation will not be more than 4 calendar weeks from the date of site handover.
- Works can be carried out in both collapses at the same time concurrently or one after the other provided the overall duration is respected