

SHAHJAHANI MOSQUE CONSERVATION


Baghe Babur, Kabul



THE AGA KHAN TRUST FOR CULTURE

Completion Report

Ratish Nanda, Conservation Architect
January 2005



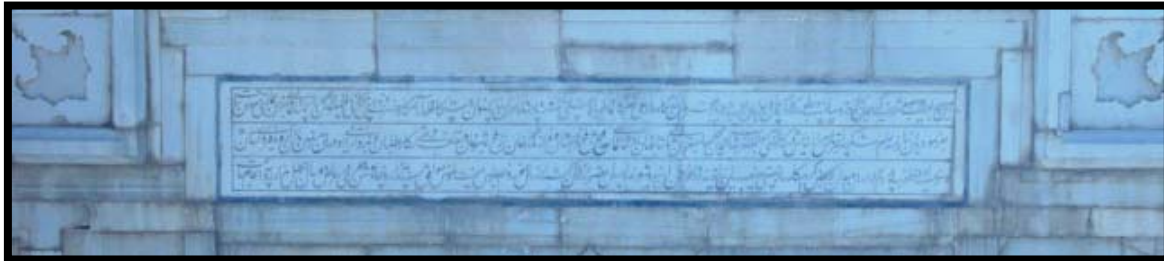
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History



*This beautiful mosque, this noble temple,
 which is a place of prayer for saints and the spot where Cherubs appear,
 the only building worthy of a sanctuary as venerable as this path of the Angels,
 of this theatre of celestial beings, that is the luminous garden of the king forgiven by God, the angelic, whose
 place of rest are the celestial gardens,
 the Heavenly Majesty of Zabiruddin Muhammad Babur the victorious,
 was completed after two years labour, at an expense of forty thousand rupees,
 by order of this man eager for the favours of God, who is completely devoted to thanksgiving, who is from head
 to foot praise and adoration of the Divine Court,
 Abul Muẓaffar Shabbuddin Muhammad the fortunate king,
 Shah Jahan the Victorious, in 1056 of the Hejira,
 at the end of the nineteenth year after his happy accession to the throne,
 after the conquest of Balkh and Badakshan and the flight of Nazr Muhammad Khan from Balkh to
 Shibarghan and the pursuit of a part of his followers through those lands by this victorious army and his
 defeat and the victory of the valiant army on that battle field thanks to the favour of God upon this worthless
 servant of His.¹*

¹ Inscription on the mosque, translation from *The Newly Restored Mosque in Baghe Babur, Kabul*, General Directions of Museums and Antiquities of Afghanistan, Kabul, 1966

Babur, in the early 16th century, built the garden today known as Baghe Babur. Of the over ten gardens he is known to have built in the Kabul region, it is the only surviving garden and its survival can best be attributed to Babur, the first Mughal Emperor having been buried here and his successors, notably the emperors Jahangir and Shahjahan making a pilgrimage to the garden and ordering additional structures to be built here.

Shahjahan, better known as the builder of the famed Taj Mahal, commissioned the white marble mosque in Baghe Babur in AD 1638. Sited to the west of Babur's grave enclosure, on a lower terrace within the garden, the mosque is one of the most significant historical buildings in Kabul. As with the Taj and Babur's grave enclosure, white marble was the predominant building material used for the construction of the Mosque. Building elements such as the foliated arch, decoration on the plinth and the original parapet used for the mosque are also typical of Shahjahani buildings.



In the 350 year history of the mosque several alterations, additions, repairs have been carried out on the building. Though the exact time and reason for this remains undocumented, sometime in the 18th or even in the early 19th centuries, the original Shahjahani parapet seems to have been removed and replaced with the parapet that stands on the mosque today. The eight minarets also date from this intervention and the desire to have minarets on the mosque could possibly have dictated the replacement of the parapet.

Original parapet piece reused in the plinth, discovered during recent surface archaeology investigations

Water penetration from the roof seems to have necessitated the erection of a sloping roof on two occasions. During the first intervention traditional materials – timber, mud and thatch seemed to have been used and a contemporary photograph shows the



timber sagging under the weight of a traditional mud roof. The second sloping roof used metal sheeting and the space between the marble roof and the sloping roof seems to have been accessible and usable. The mosque was also fenced off from the garden along with the new roofing thereby segregating the public/social zone from the religious use.



The first documented roof addition, possibly to prevent water seepage, 19th century.



The second documented alteration/addition to the roof.

The most serious intervention on the mosque building was undertaken in 1964-66 when the Italian Archaeological Mission undertook a major restoration of the building. A Kabul guidebook printed in 1972 states, *‘It stood in a deplorable state of disrepair for thirty years after it was partially dismantled preparatory to restoration. Happily the Italian Archaeological Mission has finally restored it to its former beauty. This work was carried out under the direction of BC Bono from 1964-66’*. Also, a brochure published by IsMEO and General Direction of Museums and Antiquities of Afghanistan reads, *‘This beautiful mosque, which is an extremely important specimen of Moghul architecture, was in a deplorable state of disrepair because of an unsuccessful restoration begun and then stopped over ten years ago.’* It further goes on to say, *‘The restoration work, which required a complete dismemberment of the ruined monument ... under the supervision of the Italian Archaeological Mission. Each stone has found its own place; where there were gaps new marble slabs have been employed which bear the dates 1966 or 1345.’*



Recently discovered photographs show that the mosque was in a state of complete collapse when the Italian Archaeological Mission commenced reconstruction works. Using the concept of Anastylis approved in the 1964 Venice Charter the dismembered stone pieces were reassembled in the reconstruction process by the Italian team. However, instead of using traditional building materials and techniques for the masonry, cement concrete seems to have been favoured during this reconstruction. As such, though any stones were carefully inscribed with the date 1966 the traditional masonry was replaced with rubble masonry in cement mortar and Reinforced Cement Concrete (RCC) columns and roof slab were used as the structural elements.



The west wall was rebuilt using RCC columns at the edges, a RCC plinth beam and brick masonry in cement mortar finished with white cement plaster. It is explained that, in the absence of enough evidence of the exact stone pattern, the stones found at the site and possibly belonging to the west façade were not used with the reasoning, ‘.. *the back wall- facing which underwent a complete destruction has been replaced with a hard plaster surface, since it proved impossible to ascertain the details of its features. This solution has been suggested by the need of scientific correctness; a completion of the marble facing will be possible at any time.*’²³ The columns on the eastern façade have yet to be investigated but it could be said with some certainty that these, like the SW and NW columns would be in RCC with infill rubble in cement mortar ‘thrown in’ to fill the cavities.

Three of the long marble roof slabs seem to have been repaired during the 1966 restoration- these seem to have cracked and could possibly have been the reason for the collapse/ dismantling of the mosque in the first place. Placed at the edges of the three bays – where these enjoy extra support, the repairs are marked by concrete humps (see adjoining picture) over the roof. The marble slabs were covered with an ‘RCC slab’; the slab had reinforcement at 15-20 cm interval using 8 mm circular bars in both directions (see photos on next page). The aggregate size ranged from 10mm – 500 mm with most stone aggregate particles being the rounded river pebbles – unfit for use in an RCC



² *The Newly Restored Mosque in Baghe Babur, Kabul*, General Directions of Museums and Antiquities of Afghanistan, Kabul, 1966.

³ Translated from the Persian version of the brochure, the text regarding the west wall reads, ‘*The wall coating of the rear wall, that had been completely destroyed, its material and its construction methods were not recognizable and resolving the issue necessitated scientific and technical research, therefore at present, instead of marble, a strong plaster coating has been used. Anytime the material and construction method of the previous, old building is clarified in the future, it is very simple to replace the plaster with marble...*’. Translation provided by Cameron Rashti, AKTC, Geneva. Though both versions admit to the possibility of

Slab. The slab was itself covered with a bituminous layer of waterproofing, as were the parapets; it seems that the bituminous coat melted from the vertical surfaces of the parapet and formed shallow depressions (see photo below) on the roof- thereby creating ‘pools’ that collected water that eventually seeped through to initiate the decay process. Modern grouting materials and waterproofing layers such as silica were also used, as were iron clamps to fix the marble to the cement masonry. Under the RCC roof an iron girder and posts have also been exposed, with no apparent structural function, these seem to have been used to serve as benchmarks during the reconstruction.



marble having been used originally on the west wall, the Persian version, which would have been read by the locals- more familiar with the building, admits to the marble being replaced by plaster.



Concrete removal in progress, using hand tools and after the erection of shuttering to provide additional support to the roof.



CONDITION DESCRIPTION

*...damage to cultural property belonging to any people whatsoever
means damage to the cultural heritage of all mankind
since each people makes its contributions to the culture of the world.⁴*

The Baghe Babur project currently being undertaken by AKTC is a complex project that would eventually involve conservation, restoration, and reconstruction of several built components in this 16th century garden. Though the project is focussed on the site as a whole and does not consider individual elements within the site as disparate parts⁵, nevertheless buildings such as the Shahjahani Mosque need to be studied in detail so as to enable the drafting of a sensitive and appropriate conservation policy for the Mosque.

The mosque was found in a state of deterioration; a variety of factors combined to cause decay and the three principal reasons were:

- ❖ Inappropriate materials used during the 1964-66 restoration (concrete, bottom left picture).
- ❖ War damage, mostly accidental and caused due to the crossfire (bottom centre picture).
- ❖ Neglect of the building and its surroundings (ferrous run off due to water seepage).



The use of

inappropriate materials such as silica, cement, iron in the 1966 reconstruction has caused

⁴ Final act of intergovernmental conference on the protection of cultural property in the event of world conflict, UNESCO- **The Hague, 1954**

much deterioration in the historic marbles. The cement concrete in the RCC slab became loose from the reinforcement bars and the slab added considerable dead weight on the marble slabs; this occurred mainly due to the use of a high aggregate size (upto 100 mm) and inappropriate rounded river pebbles being used in the aggregate. The bitumen from the parapet melted in the heat causing pools of water to form during the rains thus leading to water seepage from the roof. The water seepage was accelerated as a result of cracks and cavities created due to a rocket attack.



Water seepage over the cement concrete and the iron bars caused severe calcification and accumulation of salts on the historic marbles causing severe damage that would require some stone replacement. Furthermore the roof slabs and the cornice stones have been stained with ferrous

run-off. In a situation seen rarely in marble, damp patches are visible on the roof slabs indicating the accumulation of a significant amount of water, over the years, in the cavity between the marble and the RCC slab.

The inside west wall has severe accumulation of silicates possibly indicating a coating of silica on the outer face and gradual movement of salts on the interior face. The marble joints were filled in with white cement thereby not permitting any accumulated dampness or resulting salts to escape from within the masonry.

⁵ Athens Conference, VII a, 1931

In the central bay one of the marble slabs, 3000 mm+ long, 400 mm wide and over 150 mm thick on average was supported on the west cornice with an overlap of only 25 mm. Though the slab was supported on the adjacent stone with a minor lap joint it nevertheless resulted in cracking in the 2 m cornice stone (see picture below) causing it to split.



During the two decades of war and strife, Baghe Babur was on the frontlines, unused ammunition (rocket propelled grenades, tank artillery, among others) continues to be regularly discovered within the site. During this period the trees and vegetation were destroyed ostensibly to provide a clear line of firing. Some of the buildings within the garden such as the Queen's Palace were almost completely gutted. Though the mosque escaped serious damage, bullet marks and damage caused by shrapnel is evident all over the building, especially on the south façade. The SE column as well as the SW edge of the building both have serious damage caused by explosions which in the case of the SW column has structural ramifications.

The building seems to have been left uncared for over the last two decades, the roof being inaccessible coupled with a missing waterspout and cracks in the RCC allowed water

accumulation on the roof and subsequent penetration. A water channel to the east of the mosque feeding the upper water reservoir has been leaking for several years causing water accumulation in the grounds adjacent to the mosque. With the surroundings of the mosque paved with stone over cement concrete the water accumulates under the mosque causing rise of damp and deterioration (picture below) of the flooring.



CONSERVATION WORKS, 2003 - 04

*‘... the well being of all peoples depends,
inter alia, upon the existence of a favourable and stimulating environment and that
the preservation of property of all periods of history contributes directly to such an environment’⁶*

The benefits to be gained from protecting the cultural heritage as seen by the international community, are far broader, more fundamental, and more populist than could have been conceived by the first conservationists. As such conservation of Afghanistan’s rich cultural heritage are seen as an important and essential component of the reconstruction activity being carried out with international support. It is also essential to include public participation in the process of analysis and evaluation of what is valuable⁷ and needs to be conserved on a priority basis. The Baghe Babur and the Shahjahani mosque that stands within it are considered to be amongst the most significant sites both amongst visitors to the city and the local populace.

The significance of the mosque building stems not only from the date of its original construction in the seventeenth century but also from the fact that it was built by the Emperor Shahjahan who also built the famed Taj Mahal in Agra, India. Cultural Heritage is today broadly understood to include sites possessing, ‘... **historical, archaeological, architectural, technological, aesthetic, scientific, spiritual, social, traditional or other special cultural significance associated with human activity**’⁸. Thereby, despite the reconstruction⁹ of the mosque in 1966, it retains enough authentic material and the ‘new

⁶ UNESCO, Paris, 1968

⁷ Petropolis (Itaipava) Charter, 1987

⁸ ICOMOS New Zealand Charter, 1992

⁹ Reconstruction can be described as, ‘returning a place as nearly as possible to a known earlier state and is distinguished by the introduction of (new) materials into the fabric’ – Burra Charter 1.8. This is in variance from the concept of *Anastylosis*, which is described as ‘The re assembling of existing but dismembered parts’ - Venice charter 15

work¹⁰ carried out is identifiable on close inspection though it could be argued that it does impair the aesthetic integrity of the building when individual stones are repeatedly inscribed with the date ‘1966’.

The proposed and ongoing conservation works on the Mosque are governed by the international guidelines and follow an approach on minimal intervention¹¹ in order to ensure long term stability of the structure using traditional building materials and techniques¹² and using the project as a training ground¹³ for Afghan professionals and craftsmen.

The project commenced with a detailed survey¹⁴, involving archaeological excavation, photo documentation, archival research, architectural measured drawings and chemical and structural analysis of materials. The measured drawings (digitised), included detailed documentation of the marble paving around the mosque and the roof structure after the removal of the RCC slab; the latter drawing made it clear that one of the marble slabs did not have enough support on the projecting cornice and corrective measures could be taken. Health and Safety concerns while works were ongoing led to the mosque being fenced off as a temporary measure and public access to the site restricted until October 2004.

Abutting the mosque the grounds on the north, east and south had been paved with white marble fixed on cement bedding sometime since the 1966 reconstruction since the IsMEO



brochure states, ‘Some decorated marble pieces belonging to a dismembered funerary precinct and several grave slabs which were found re-employed in the mosque, are now displayed nearby, on the retaining wall to the east.’¹⁵ These stones seem to have been reused in

Datta Charter 3, Conservation is based on a respect for the existing fabric.

¹² ‘Materials and Techniques should respect traditional practice’ – Burra 14, Venice 10, Athens IV

¹³ The Amsterdam Charter, 1975; *the architectural heritage has an important part to play in education. The architectural heritage provides a wealth of material for explaining and comparing forms and styles and their applications.*

¹⁴ Thessaloniki Charter, Sophia Principles; any work on the site must be preceded by professionally prepared studies of the physical documentary and other evidence of its cultural value including where relevant an archaeological analysis of the ground.

¹⁵ *The Newly Restored Mosque in Baghe Babur, Kabul*, General Directions of Museums and Antiquities of Afghanistan, Kabul, 1966.

the paving thereby damaging them and causing damp accumulation in the mosque and it was clear that historic stones had been reused in an inappropriate manner to pave this portion. After careful documentation of the paving pattern these stones were carefully removed; revealing a wealth of historic stones including several from the original Shahjahani parapet. Some stones from Babur's tomb enclosure were found and several ornamental gravestones had been used for the paving. Several uninscribed, unornamented marble pieces of approximately 12- 15 cms thickness were found in a few standard sizes – it can be said with little doubt that these would have originally belonged to the west wall.

ROOF

Water penetration from the roof and resulting dampness, ferrous run offs and salt formation on the marble causing irreversible deterioration was one of the prime concerns in the building. As a part of the analysis a small portion of RCC was removed from the location of the rocket damage; this revealed the condition of the roof slab described earlier in the report and led to the decision to dismantle the RCC to replace it with a traditional lime concrete slab.



In order to commence removal of the RCC slab, shuttering was erected within the mosque to cushion against the vibration caused during the removal process. Even though the RCC slab was chipped off over a month using hand tools, the shuttering, as a precautionary measure was still considered necessary; even more so in the central bay where the shuttering was further consolidated with the erection of brick piers in mud mortar as the west cornice had severe existing cracks. On the completion of the removal of the RCC a detailed inspection of the roof slab was carried out; this revealed the existence of vertical and horizontal 'T' sections, possibly used in the 1966 reconstruction to serve as benchmarks- some of the cornice stones were fixed to the horizontal section using iron rods. The fact that the three marble plates

that had visible cracks were repaired during the 1966 reconstruction as earlier envisaged and as such did not require repair or replacement.

Following documentation of the marble plates it became evident that replacing the damaged west cornice of the central bay would not be sufficient as with the limited overlap and high point load the new cornice was likely to crack in a similar fashion. The marble plate was temporarily supported using jacks and a brick masonry pier, 1m square in plan and built in mud mortar. This temporary support allowed the damaged cornice to be removed and be replaced with a new cornice stone 1.2 m long prepared in carefully selected marble from the quarries in the Wardak region and using only hand tools in order to encourage traditional craft techniques. Once the new cornice stone was in place, in order to avoid a recurrence of the damage and to provide extra support to the marble plate, an additional ‘T’ shaped marble stone was placed over it. Extending 100 + mm over the cornice with a chamfered edge, this stone was used to support the marble plate. Though visible from below, it is a repair meant to stabilise¹⁶ the roof structure with a minimal intervention¹⁷ and that too with the same material- marble, prepared using traditional tools and techniques¹⁸.



contact and in a fixed position – Burra 12

IV

The support stone for the cornice being prepared (picture above) and the cavity in which it was to be fit (left).



While repairs were ongoing to the central bay structural elements preparations were made to lay a new yet traditional lime concrete roof on the Mosque. Carefully selected quicklime was slaked on site (left picture) and kept under water for a period of eight weeks, allowing the lime particles to progressively reduce in size producing an



increasingly higher quality of material. A lime wheel was built and for the final preparation of lime concrete the lime was mixed in a ratio of 1:1:1:3 (Lime: Sand: Brick dust: Brick aggregate) traditional waterproofing and air entraining agents such as molasses and fruit



pulp were added to the mix while preparation (*see picture above* – liquid molasses being added to the mortar mix). Traditional materials such as lime-based mortars are much less tolerant of poor site practice and as such an emphasis on training and high level of supervision of the craftsmen was considered important during the course of the work. The well-graded sand was carefully chosen after studying the void ratio and granular nature of a variety of sands; once procured, the sand was carefully sieved prior to use. Fine brick dust- below 50 microns, crushed from soft-fired bricks was used as a pozzolonic additive to promote a chemical set in the mortar. The brick aggregates comprised a significant volume of the lime mortar and brick



aggregate was chosen as a filler, reducing the amount of lime needed and thereby reducing drying shrinkage in the mortar while keeping the lime concrete light in weight. The aggregate also serves as an air entertainer and thus contributing to frost resistance to the mortar while also increasing

the compressive strength. The mortar was prepared in the lime wheel – where the lime, sand and brick dust were compressed and beaten together under a 200-kilo stone wheel. The aggregate was then mixed with the mortar in a regular cement mixer. Over 10 cum of lime



concrete was poured onto the roof of the mosque in 1½ days. (Picture, left: masons, labour, architects after the completion of the lime concrete slab)

A temporary metal roof was erected over the mosque in order to protect the roof from rain and snow over the winter periods, allowing the lime concrete a gradual drying period. The concrete was kept damp using jute sacks and rammed for over three hours daily over a fortnight to fill in any shrinkage cracks in the lime. A steep slope in the lime concrete allows it to drain quickly.

The new lime concrete slab was left open, under the protection of the temporary metal roofing over winter 2003-04 and works were once again resumed on the roof in May 2004.



Shahjahan's Mosque, Baghe Babur Conservation Initiative
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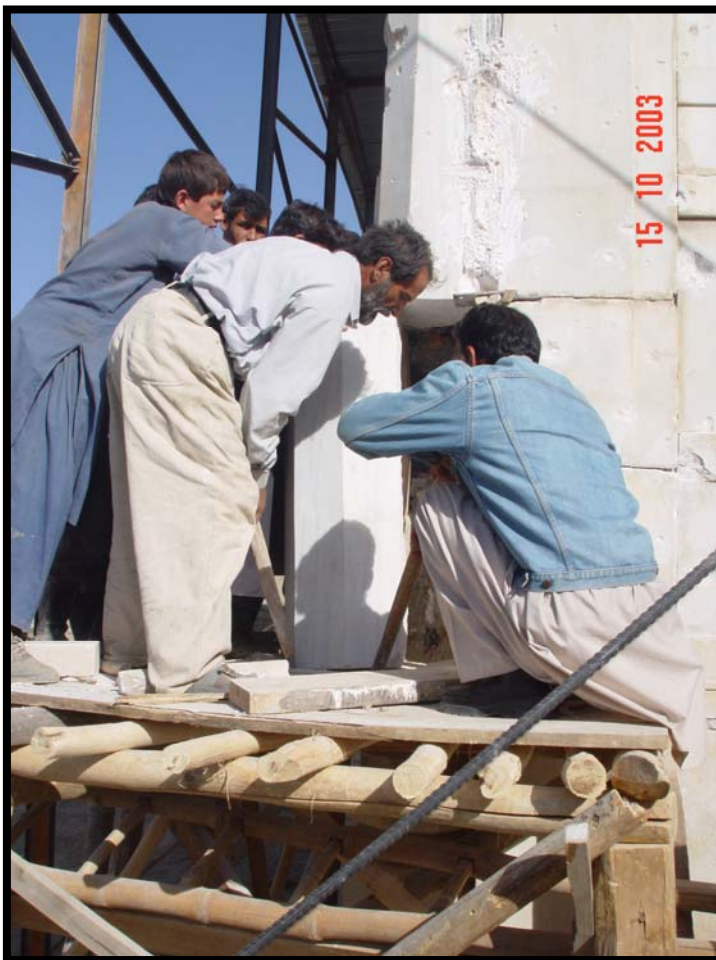
Following the repairs carried out on the parapet, described later, a lime based water proofing coat was applied to the roof. This was followed by a layer of bricks (200 mm x 200 mm x 40 mm) in lime mortar over the lime concrete to serve as an additional protection.



MARBLE ELEMENTS

Besides the marble cornice, damaged due to severe point load, other marble elements on the mosque have suffered war damage and have also deteriorated due to salt damage caused by using inappropriate materials during the 1966 restoration. For purposes of preparing a strategy for conservation, the marble needing conservation either by repair or replacement could be categorized as follows:

- a. Where damage is affecting structural stability of the building.
- b. Serious war damage such as on the south-east pier
- c. Serious salt damage affecting the structural integrity of the stone.
- d. Minor war damage but serious aesthetic defacement
- e. Minor damage to 1966 stones either due to war or damp or salt formation.



After considered discussion within the project team during routine monthly meetings it was considered unnecessary to repair the minor war damage such as bullet marks with replacement. Stones heavily damages or performing structural functions were to be replaced – eventually, four stones were replaced; these were : portion of south facing of SE pier, part of SW column, west cornice of central bay and portion of a cusped arch in the central bay.



Various marble quarries (*picture above*), all within 150 kms of Kabul were visited to identify matching and appropriate marble for use during conservation works. Most quarries were not functional but it was considered inappropriate to use the commercially available imported marble tiles and as such special efforts were made to procure large blocks of stone that were then worked upon using hand tools on site. The final polishing of the stones for those already prepared and those are in preparation was also carried out by hand to match the finish of the original stones.

Of the two marble waterspouts on the roof, the northern spout was missing. This was replaced in marble on the basis of the design of the southern spout and as such there was no conjecture involved¹⁹.

¹⁹ Burra Charter 14

WEST WALL



After a careful analysis of the marble recovered from paving, channels etc within the garden the pattern on the west wall was determined; this was later confirmed with



archival pictures dating from 1962. In order to install the facing the wall – rebuilt in 1966 – had to be cut back (*picture left*) and a new brick wall built (*picture next page*) with which the marble slabs were fixed using specially imported gun-metal dowels.

The restored facing uses upto 80% of stone that was found in the garden and in most probability would have belonged to the west wall in the first place. The replacement of the brick masonry in cement mortar and marble facing would also ensure the reduction of silicates forming on the marble of the inner west wall.

The new brick wall being built to receive the marble slabs.



The marble collected from within Baghe Babur, set in patterns as per the internal wall facing and pictures from 1962.



*Marble facing being built into the new
brick wall.*



*Gun metal clamps were used to anchor
the marble slabs to the brick wall.*



*The marble craftsmen, master mason
and assistant labour fixing the top
marble row.*





The west wall after the completion of the marble facing, repair of the parapet and removal of the temporary roofing. Marble slabs on ground are for the paving.

PARAPET

The parapet of the mosque was rebuilt during the 1960's reconstruction in rubble masonry with cement mortar. The poor masonry was causing water seepage into the masonry leading to salt formation on the marble facing of the walls in the mosque. Also, the marble facing of the parapet was partly missing and was in a state of collapse in several parts.



The parapet was carefully dismantled with each of the stones in the facing carefully numbered prior to being dismantled. The parapet was then rebuilt in brick masonry with lime mortar.

The marble facing of the parapet was then re-installed on the building with the section over the central *mibrab* faced with the originally

Shahjahani parapet, several fragments of which were discovered in the surface archaeology exercise.



Metal clamps were prepared at the cost of \$1/ clamp to hold the marble to the masonry while the lime was carefully cured over a fortnight.

The parapet was plastered over on the internal side and a *gola* provided at the junction with the roof to prevent penetration of water in the parapet – roof joints. On completion of works on the roof and removal of the temporary roof a marble coping was built over the parapet.

CLEANING

Salt analysis provided information suggesting that the salt formation was primarily due to water penetration in the cement roof. Prior to suggesting any replacement of stones it was decided to undertake a careful cleaning using soft brushes and moist cotton cloths. This was



extremely successful and almost 100% of the salt accumulations and ferrous stains. Some of the stones put in during the 1966 reconstruction that had heavy discoloration and scaling had to be replaced. In the process of removing these stones in the flooring it was discovered that during the 1966 restoration some stones from Rubbaiya Sultana Begum's tomb were reused in the mosque paving; no further removal of stones to ascertain extent of reuse was carried out. During August – October 2003, prior to the cleaning, all the joints in the stonework that were pointed with white cement were carefully opened up using a handsaw;

this would now allow any water accumulation during the laying of the new roof to escape from the masonry easily and not encourage any further salt formation.



Shahjahan's Mosque, Baghe Babur Conservation Initiative
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SURROUNDINGS

Along with ongoing conservation works on the mosque structure itself, ongoing works in the garden will result in the gradual enhancement of the setting of the Shahjahani building. The relationship with the Babur's tomb terrace on the east will be improved with the removal of the existing parapet followed by the construction of a masonry enclosure of the royal burial area²⁰. Repaving the existing pathway to the south together with sensitive landscaping including planting of large trees and arghwan plants and also regarding of earth will restore relationships with the surroundings and the Queens palace. Archaeological excavations to the west of the mosque have revealed underlying archaeology which means that these areas will be left largely open but the planting of Chenars on the western terrace and towards the northern portion would tie the mosque in with the rest of the garden while a double row of cypress to the north will provide a level of solitude, essential for a place occasionally used for prayers by visitors to the garden.



²⁰ For details of the proposal refer to the relevant report and drawings of the Tomb area.

