Table of Contents

EXECUTIVE SUMMARY

Fort & Shalamar Gardens in Lahore, Pakistan were inscribed on the World Heritage List of monuments in 1981. The state of Conservation of the Fort and Shalamar Gardens were discussed in the 41st Session of the World Heritage Committee in July 2-12, 2017 at Krakow, Poland. In that particular session the Committee took various decision and requested the State Party to implement them and submit a State of Conservation report to the World Heritage Centre for its review in the 42nd Session of the World Heritage Committee.

The present State of Conservation Report consists of two parts. In the first part, progress on the decision of the 41st Session of the World Heritage Committee has been elaborated. A high power Committee comprising of official members of different Government Departments, public representative & stakeholders has been constituted to work out a viable solution for the possible dislocation of a large number of people for modification of boundaries of the world heritage properties. The Visual Impact Assessment conducted through an internationally renowned firm has been submitted to World Heritage Center. Government of Pakistan has also extended the invitation to Joint World Heritage Centre/ICOMOS Reactive Monitoring Mission to visit World Heritage Property in Lahore through Permanent Delegate of Pakistan to UNESCO. Furthermore, the State Party realizing the importance of the Outstanding Universal Value (OUV) of the Property conducted all possible studies to check any impact of Orange Line Metro Train Project on it and data collected through scientific analysis has proved that there would be no impact on the World Heritage Property that could compromise its Outstanding Universal Value.

The second part of the report deals with the conservation efforts of the Government of the Punjab for Lahore Fort and Shalamar Gardens. Comprehensive conservation plans for the preservation and restoration of Lahore Fort and Shalamar Gardens of the cost of PKR- 300 million ($2.89 million) each were chalked out in 2006.

The Master Plan for Preservation and Restoration of Shalamar Gardens has been critically reviewed after holding a number of meetings of project Technical Committee and Steering Committee as it was not possible to execute work due to old rates and some variation in the items of work. The conservation work under the project remained suspended during 2016-2017. The

revised scheme has been approved by the competent forum to the cost of PKR.290.90 Million and its implementation has been started.

Lahore Fort has been given under administrative control Walled City of Lahore Authority (WCLA). The WCLA has also reviewed the previous conservation plan (of PKR- 300 million) and reframed a comprehensive revised project at a cost of more than PKR- 964.087 million which has been approved by the competent forum.

STATE OF CONSERVATION OF WORLD HERITAGE PROPERTY
FORT AND SHALAMAR GARDENS, LAHORE

INTRODUCTION

Lahore has a long history starting from 2nd century BC to present day. It is the provincial capital of Punjab province of Pakistan with population of more than 11.00 million today. In Mughal period that had started in 1526 and ended at Lahore in 1763, this city turned into jewel of architecture. A number of historic buildings were built by Mughal emperors and among them most famous were Lahore Fort and Shalamar Gardens. Considering their historical significance and architectural value, Shalamar Gardens and Lahore Fort were placed on the World Heritage List in 1981. Since their inscription on the World Heritage List, these monuments have become major tourist attraction for the tourists from homeland and abroad. However, in the year 2000, these monuments were placed on the World Heritage in Danger List as their condition had deteriorated. The Directorate General of Archaeology, Punjab had made concerted efforts to revive the glory of these monuments in accordance with the decisions of the World Heritage Committee.

Soon after assigning the responsibility of their maintenance, the Punjab Government had started two conservation and development schemes prepared under the guidelines given in the UNESCO's Master Plans prepared in 2006. Govt. of the Punjab had approved Rs.300.00 million each for Lahore Fort & Shalamar Gardens for their conservation, preservation and provision of tourist facilities. These schemes are still ongoing and at presently have been revised to meet the requirement of the latest requirements for preservation and restoration of these particular monuments.

It is pertinent to mention here that with the strenuous efforts of the Directorate General of Archaeology, Punjab the World Heritage Committee decided to remove the property from the World Heritage in Danger List under Decision **36 COM 7A.28** in its 36th Session held in, 2012 at Saint-Petersburg. It was a great achievement not only for the Directorate General of Archaeology but also for Government of the Punjab. Although these monuments have been removed from the World Heritage in Danger List but still Government of the Punjab has not let up its efforts and is

working hard for the betterment of these monuments with the same enthusiasm as it was done before their removal from World Heritage in Danger List. As a result of continuous efforts the present State of Conservation of these monuments has further been improved much and more pleasing than what it was in 2012 when it was removed from the World Heritage in Danger List.

Part-1

RESPONSE TO THE DECISION OF THE WORLD HERITAGE COMMITTEE

DECISION -1 Having examined Document **WHC/17/41.COM/7B.**Add.2,

RESPONSE No response required.

DECISION-2 Recalling Decision **40COM7B.43,** adopted at its 40th session (Istanbul/UNESCO, 2016),

RESPONSE No response required.

DECISION-3 Notes that the Reactive Monitoring mission will be invited immediately after the decision of the Honourable Supreme Court of Pakistan is announced;

RESPONSE In accordance with the decision of the World Heritage Committee, Reactive Monitoring Mission has been invited immediately after the decision of the Honourable Supreme Court of Pakistan regarding the Orange Line Metro Train Project on 8th December, 2017. On 14th December 2017, the Government of Pakistan has extended the invitation to Joint World Heritage Centre/ICOMOS Reactive Monitoring Mission to visit World Heritage Property in Lahore through Permanent Delegate of Pakistan to UNESCO vide letter No. PDU-15(1)/CLT/17.

DECISION -4. Also notes that the State Party is undertaking measures to control and monitor urban encroachments and stresses upon the need to expedite this process as far as possible and request the State Party to further improve the collaboration with the related national and local authorities in implementation of the Management Plan.

RESPONSE The Government of the Punjab has constituted a Committee under the Chairmanship of Commissioner, Lahore Division, for the modification of boundaries of the property which includes members from the national &local authorities, public representatives, as well as, Planning & Development Department, Government of the Punjab. The Committee is working for the amendment of boundaries of the Property in accordance with the recommendations of the World Heritage Committee and for better implementation of the management plan of the World Heritage Property. Due to involvement of various stakeholders and displacement of large number of people residing in the neighborhood of the property, progress of revisiting the boundaries of the property and Buffer Zone is not in accordance with the anticipated timetable. However, as soon as the draft proposal of the revised Buffer Zone will be finalized, it would be submitted to the World Heritage Centre for its technical review. A comprehensive survey is also being carried out around the Shalamar Gardens to assess the cost of acquisition of land and properties falling in the notified Buffer Zone. The Committee is now actively working for the implementation of the Management Plan in the light of recommendations of the World Heritage Committee.

DECISION-5a. To urgently complete and share with the World Heritage Centre the Visual Impact Study as decided by the World Heritage Committee at its 40th session as soon as possible, and at the latest on **1 December 2017**;

RESPONSE The desired Visual Impact Studies have been completed by the internationally recognized consultants. The State Party submitted the Visual Impact Assessment Report to WHC on 29th November 2017 through E-mail. The hard copy of the VIA Report has also been sent to the Director, World Heritage Centre, UNESCO, 7, Place de Fontenoy, Paris. The conclusion of VIA Study reflects that the visual impact from any location inside the gardens can be minimized by planting high trees and by integrating the colour and material of the Orange Line structure with the surrounding buildings. The visual integrity and the outstanding universal value of the world heritage property will not be impacted by the planned metro construction. In addition, landscape of the area surrounding orange line structure in front of Shalamar Gardens will be decorated with motifs and other similar features. Plants and creepers on the piers will reduce any visual impact. Various other mitigation measures proposed in Visual Impact Assessment and Heritage Impact Assessment reports will be adopted to enhance the landscaping and visual improvement of the area.

DECISION-5b To invite a joint World Heritage Centre/ICOMOS Reactive Monitoring Mission to the property immediately after the announcement of the decision of the Honourable Supreme Court of Pakistan, to examine the Orange Line Metro Train project and to discuss the same with the relevant Government authorities and to review the management and protection arrangements of the property;

RESPONSE The Honourable Supreme Court of Pakistan has announced its decision regarding the Orange Line Metro Train project on 8th December, 2017. Immediately after the announcement of the decision by the Honourable Supreme Court of Pakistan and as per decision of the World Heritage Committee, the Government of Pakistan has extended the invitation to Joint

World Heritage Centre/ICOMOS Reactive Monitoring Mission to visit the Fort and Shalamar Gardens in Lahore (Pakistan) through its Permanent Delegate to UNESCO to review the management and protection arrangements of the property.

DECISION-6. Considers that the highest priority must be given to considering how the Shalamar Gardens and their spiritual associations can be sustained alongside any necessary measures to satisfy the needs of a growing city, by setting out the precise and detailed nature of the potential impacts of the Orange Line Metro project on the OUV of the property, and whether and how mitigation measures can be undertaken;

RESPONSE The State Party agrees and fully realizes the importance of the Outstanding Universal Value (OUV) of the Property. The Orange Line Metro Train Project is one of the major steps taken by the Government of the Punjab to satisfy the need of the growing city of Lahore without compromising the heritage values of the Property. All possible studies including HIA, EIA, VIA and Vibration Analysis Reports conducted to check any impact of Orange Line Metro Train Project on the World Heritage Property. The data collected through this scientific analysis have proved that there would be no adverse impact on the World Heritage Property that could compromise its Outstanding Universal Value. Furthermore, the studies confirmed that implementation of the project would reduce the vehicular traffic &congestion near the World Heritage Property that would rather have a positive impact in the form of reduction of noise, vibration and air pollution.

DECSION-7. Reiterates the great need to adequately manage and effectively control encroachment and urban development in and around the property, and therefore further requests the State Party to immediately undertake setting studies and procedures in this regard, which will be taken into account when proposing an enlargement of the property's buffer zone;

RESPONSE The State Party is aware of its obligation towards the control of encroachment and urban development around the World Heritage Properties as well as other monuments located within the city. The Directorate General of Archaeology, Punjab and local authorities have actively been addressing the encroachment issues around the World Heritage Property and tried its level best to control any new construction around the monument in accordance to the provisions of Antiquities Act 1975.The Government of the Punjab has also constituted a high level Committee in the year of 2016 which includes not only the official members of different Government Departments, but also public representative and stakeholders to work out a viable solution for the possible dislocation of a large number of people. After several marathon meetings, the Committee decided to include the Urban Unit of the Planning & Development Department, Punjab which is a specialized cell to handle such issues, to prepare a comprehensive proposal for the creation of standard buffer zone around the monuments and to conduct a setting study for Property. A comprehensive survey is also being carried out around the Shalamar Gardens to assess the cost of acquisition of land and properties falling in the notified Buffer Zone. Due to involvement of displacement of large number of people residing in the neighborhood of the property, progress of revisiting the boundaries of the property and Buffer Zone is not in accordance with the anticipated timetable. However, as soon as the draft proposal will be finalized, it would be shared with World Heritage Centre.

DECISION-8. Notes the conservation work that has been undertaken at Lahore Fort and is in progress at the Shalamar Gardens, and requests furthermore the State Party to ensure that all such work is documented, together with any necessary archaeological inputs;

RESPONSE The Directorate General of Archaeology has been carrying out all conservation works after complete documentation at every stage of execution at Lahore Fort and Shalamar Gardens. The conservation work executed at these sites was in accordance with the international principles and advice / input of a Technical and Steering Committees comprising of eminent professional archaeologists, architects & engineers and their recommendations have always been valued by the Government of the Punjab to safeguard the World Heritage Properties.

DECISION-9. Finally requests the State Party to submit to the World Heritage Centre, by **1February 2018**, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 42nd session in 2018.

RESPONSE The state of conservation report has been prepared in accordance with the advice and decision of the World Heritage Committee and being submitted herewith to the World Heritage Centre for its review and assessment.

Part-2

STATE OF CONSERVATION

LAHORE FORT

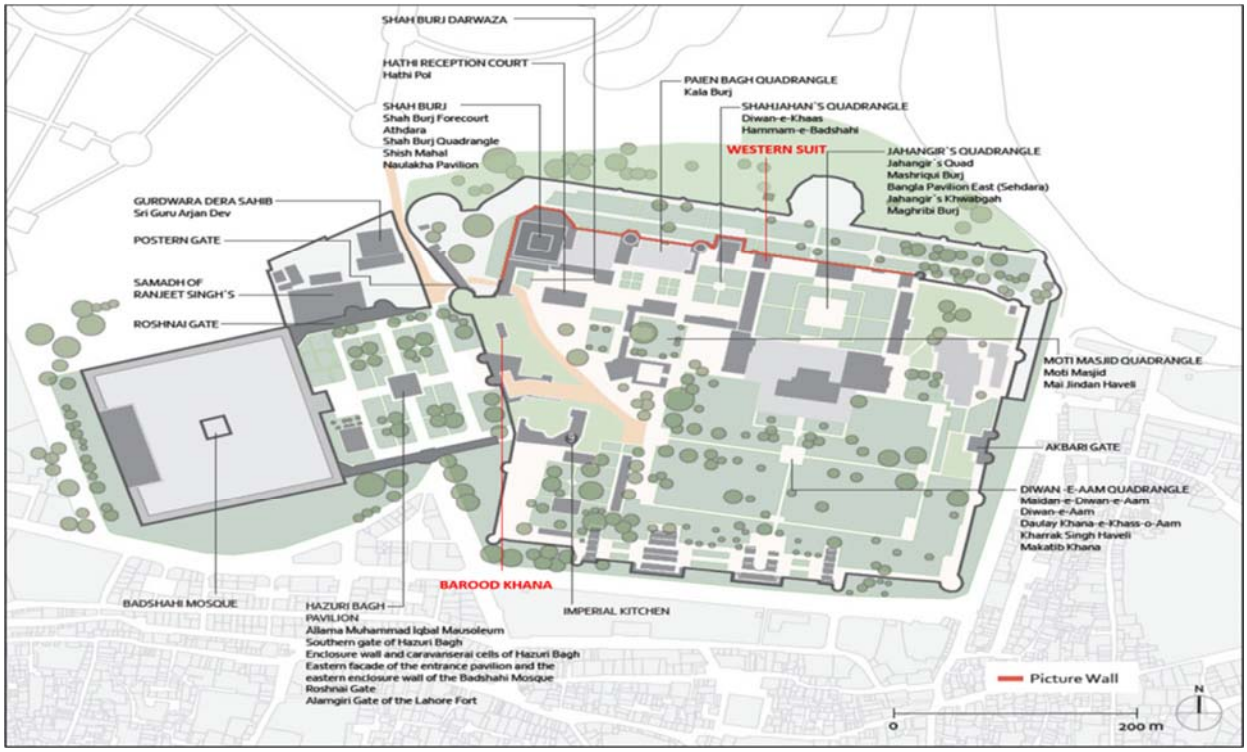
Lahore fort is the only monument in Pakistan represents a complete history of the Mughal architecture. The architecture of Akbar's period in the fort is characterized mainly by the use of red sandstone and cut brick work. The use of animal figures such as lion, elephant, and peacock as well as sculptured gargoyle, as brackets to support the chajja shows the Hindu elements in the Mughal architecture of Akbar's period. More or less the same style continued in the buildings of Jahangir. The buildings of the period of Shah Jahan and Aurangzeb provide a striking contrast with the former. The use of marble in place of sandstone and exuberance of the Persian motifs, pietra dura and tile mosaic work are the chief characteristics of the buildings added by Shahjahan known as prince architect of South Asia. The fort is situated north east corner of the city. It contains irregular shape in surroundings and very symmetrical Mughal foot prints in garden and balance geometry can be seen in the monuments. Acknowledging the pinnacle of Mughal aesthetic, design and artistry and masterpiece of human genius, in 1981, the fort was added to the UNESCO World Heritage List along with the Shalamar Gardens. The administrative, operational and functional responsibilities were shifted from the Archeology Department to Walled City Lahore Authority on 20th October, 2014.

Since inception, Walled City Lahore Authority truly felt that the necessities of the monument are high while an intensive research work in the form of documentation of individual historic components, condition assessment surveys of structures and spaces and conservation reports are required. The ongoing activities by WCLA are dominantly includes: research work, condition assessment surveys, conservation proposals, removal of debris, upgraded tourist facilities, and consolidation & maintenance works. Some of the factual details are additionally enclosed in report in the form of description and images. Considering the facts and needs of the site Conservation Wing WCLA is more leading research work and receiving assistance from alleged international and national organizations as well.

It was observed that the allocated previous budget of PKR 300 million in 2006 was insufficient to achieve set goals of conservation therefore; it was decided in 2014 - 15 to revise PC-

I on the basis of requirements. Considering the fact and nature of activities revised PC-I with framed cost of PKR- 964.087 million has been approved by competent forum of local government office and conservation activities have been initiated.

LAHORE FORT


SHAH BURJ DARWAZA
HATHI RECEPTION COURT
Hathi Pol
SHAH BURJ
Shah Burj Forecourt
Athdara
Shah Burj Quadrangle
Shish Mahal
Naulakha Pavilion
PAIEN BAGH QUADRANGLE
Kala Burj
SHAHJAHAN'S QUADRANGLE
Diwan-e-Khaas
Hammam-e-Badshahi
WESTERN SUIT
JAHANGIR'S QUADRANGLE
Jahangir's Quad
Mashriqui Burj
Bangla Pavilion East (Sehdara)
Jahangir's Khwabgah
Maghribi Burj
GURDWARA DERA SAHIB
Sri Guru Arjan Dev
POSTERN GATE
SAMADH OF
RANJEET SINGH'S
ROSHNAI GATE
MOTI MASJID QUADRANGLE
Moti Masjid
Mai Jindan Haveli
AKBARI GATE
DIWAN-E-AAM QUADRANGLE
Maidan-e-Diwan-e-Aam
Diwan-e-Aam
Daulay Khana-e-Khass-o-Aam
Kharrak Singh Haveli
Makatib Khana
BAROOD KHANA
IMPERIAL KITCHEN
BADSHAHI MOSQUE
HAZURI BAGH
PAVILION
Allama Muhammad Iqbal Mausoleum
Southern gate of Hazuri Bagh
Enclosure wall and caravanserai cells of Hazuri Bagh
Eastern facade of the entrance pavilion and the
eastern enclosure wall of the Badshahi Mosque
Roshnai Gate
Alamgiri Gate of the Lahore Fort
Picture Wall
N
0
200 m

Conservation of the Picture Wall, Lahore Fort

Picture Wall Prototype Project

Introduction:

The Picture Wall is the most exquisite feature of Lahore Fort. It is one of the largest murals in the world (450 meters long with an average height of 15 meters) and is extensively embellished with tile mosaic and fresco panels, brick imitation and filigree work. This wall is mainly responsible for the Fort's World Heritage status as it is a classic example of the exceptional craftsmanship of the Mughal period.

Since September 2015 Aga Khan Trust for Culture/Aga Khan Cultural Service Pakistan (AKTC/AKCSP) has been in partnership with the Walled City of Lahore Authority (WCLA) for the documentation of Picture Wall as part of the larger Lahore Fort conservation project. The completion of detailed documentation work led to organization of an International Workshop in November 2016 with the purpose to "engage with the special site-specific conditions, to define possible approaches, and identify locations and types for prototypical conservation interventions" for the conservation of the Picture Wall. Based on the outcome of that workshop, a 10m wide and 15m high segment of the western wall of the Picture Wall was selected for prototype conservation.

This area, located in correspondence with the Naulakha Pavilion and the marble screen to the south, was selected, because it shows a broad range of visual, chemical, physical and structural problems as well as former interventions that can be seen all across the wall. It is therefore expected that findings in this area will be representative for the conservation of the entire Picture Wall. For an in-depth analysis of the ongoing issues and for the selection of suitable conservation efforts, six missions involving international experts from different fields have been carried out so far. A greater emphasis has been placed on conserving the original remains and reconstruction has only been done where the evidence of the details of the missing parts is strong enough and reference data was available. The prototype pilot project has now reached a stage where it is ready to be reviewed so that a course of action for the future conservation of the complete PW can be agreed upon.

The International Workshop planned for 15-17 January 2018 is aimed at assessing and reviewing the work done so far in terms of the various aspects of documentation, and the approach

and methodologies adopted for the recommended conservation interventions and presentation of the Picture Wall prototype, to arrive at a course of action for conservation of the Picture Wall that adheres to conservation principles, is authentic and is in consonance with the context.

Conservation Tasks Completed:

It is estimated that the total damage on the Western facade is around 20% in total which testifies to the impressive quality of the historic materials and techniques used for the craftwork. The loss of adhesion between the glaze and the tile body is the most visible aspect of the deterioration on the wall. In addition, a significant amount of fresco wall paintings have been lost and large sections of the horizontal frieze of filigree work is missing which was filled up with cut and dressed brickwork during the British era (1858-1947). There are a large number of micro-gaps in the joints between tile bodies on mosaic panels. In addition to the loss of the artwork, there is a rich layer of bio film covering many areas of the wall. This can be most clearly observed on top of the plaster surfaces, in between tile bodies on mosaic panels, on the bedding mortar in between the bricks and can also be observed behind the white translucent glaze as dark patches. The first and foremost part of the Prototype Project was to conduct a detailed digital documentation, condition survey and analysis of the physical and chemical problems relating to the artwork. This made it possible to experiment with possible conservation efforts on the prototype, ensuring minimal damage and maximum preservation during all interventions. An important part of this process of experimentation was to establish a logical sequence of conservation treatments. Throughout this process, many unforeseen problems were dealt with and these unexpected challenges have directed the final sequence of treatments as they are reported in the subsequent chapters.

Stabilization and Consolidation of Decorative Panels:

Over the course of four hundred years many mosaic panels have lost adhesion from the base of brick masonry. This is primarily due to the decay of the bedding mortar which is meant to bind the two together. The decay is mainly attributed to water infiltration from behind which weakens the adhesive power of the mortar. Similarly, the fresco plaster has lost adhesion to the surface due to weathering. Since the resulting fragility of the panels prevents other conservation efforts, critical areas in need for attention were identified by the team and lime based mortars were

injected into the detachments behind the panels to increase their adhesion to the wall. A manufactured lime mortar called Ledan TB1 (imported)was used for minor detachments while mortar using local materials like lime putty, kankar lime and brick dust was injected where the detachments were relatively larger.

Removal of Plaster from the British Period:

Plaster was applied on significant portions of the Picture Wall during the British Era. These areas include fresco and mosaic panels as well as the brick imitation work. Although the motivations behind covering certain areas with plaster are debatable, the functional aspect of the British plaster was certainly questionable. Over the years the plaster surfaces had accumulated layers of bacterial film and had also lost attachment to the base from many areas. Moreover, it was found to be covering existing original work which seemed to have been rather preserved by the plaster. Keeping this in mind, it was decided that all British plaster will be removed manually using suitable tools to expose the original surfaces which are hidden below these plaster.

The extreme humidity and ample sunlight the exterior façade of the wall faces has created a sustainable environment for microbial growth on the surface. This appears as a blackish layer covering much of the decorative work. However, the biofilm is not only a problem aesthetically but also functionally as it can negatively affect the physical and chemical properties of the materials. The area of growth is dependent on how much of a supportive environment the host material can provide. Therefore, it is specifically found on the joints in between tiles bodies and brick work, on all plaster surfaces as well as behind the glazes of the tile mosaic. Microbiological analysis revealed algae, fungus and cyanobacteria to be the main bacterial genes present. Preventol Ri80, a quaternary ammonium compound, was chosen as a biocide in combination and was sprayed over the surface three times with a gap of around 10 days between each application. A 10% solution of Hydrogen Peroxide, a stronger disinfectant, was then applied after which the biofilm was removed manually with brushes and a common surfactant known as Tween 20. A final preventative treatment with Melange d’ Angkor, a mineral based biocide, will be done to ensure a long-term prevention of bacterial growth.

Glaze Consolidation on Tile Mosaic Panels:

Material analysis of the tile mosaic biscuits and glaze has revealed that detachment of the glaze from the tile bodies has the most critical contribution to the deterioration of the mosaic work. The glaze has sharply distinct physical properties compared to the tile biscuits and the engobe layer in between the glaze and the biscuit. Both the tile biscuits and the engobe have incredible water absorption with a porosity of around 33% and have an intrusion hardness of 6.5 – 12.7 N/mm^2. In contrast, the glaze is water impermeable with an intrusion hardness of 1570-2600 N/mm^2 which is some 125 to 400 fold high than those of the underlying materials. These results in very different thermal responses: the tile biscuit expands and contracts much more than the glaze which means the main shearing forces appear at the interface between the glaze and the engobe. A colloidal solution of silica nano particles called Syton X30 was used to increase the binding of the glaze to the tile bodies. Micro-holes in the glazes with weak adhesion were made using hand-drills and the Syton solution was injected into these holes till maximum absorption was reached.

Consolidation of Tile Bodies:

Syton X30 was also applied on the tile mosaic panels to increase the mechanical strength of the tile bodies and to reduce their porosity. It was applied from the surface with a paint brush and the volume uptake was noted and compared to the expected uptake according to the porosity of the tile biscuits and the difference was quite large. The most efficient way of applying this binder is still being experimented with since it is a chemically sensitive solution and ensuring sufficient penetration into the tile bodies is a challenging task. Regardless, the applications done so far have indeed increased hardness and reduced water absorption of the tiles. In addition, filling of micro holes with mortar was also done to seal the surface of the mosaic panels.

Imitation Tile Mosaic:

As part of the consolidation of the tile mosaic, a silica based mortar using Syton X30/W30 was experimented with. The purpose of this mortar was to make imitation tile mosaics that can be easily reversible and can be easily adjusted to match the appearance of the original weathered tiles and glaze. This imitation tile consists of a layer of course mortar (<0.5 mm) and a thin layer (around 2 mm) of fine mortar (<0.25 mm). The smooth surface is meant to act as a paint receiving layer. Light fast and alkaline resistant pigments are used with Syton X30 as a binder. According to the experiments conducted, the Syton not only acts as a binder, but also gives a nice glossy finish

that resembles the glaze. However, the mortar itself is still tentative and being experimented with. Various local materials like brick powder, kankar dust, kankar lime, and river sand were wind sieved and washed to make around 60 samples in total. The experimentation was conducted in 3 phases, each phase revealing important information: it is necessary to apply a primer on the base since the Syton is absorbed rather quickly by the base material, greater than 20% binder is required for decent hardness and the grain-size distribution must be calculated thoroughly. The last conclusion regarding the grain-size distribution is the most challenging and therefore, this mortar is still under development. Experimentation will continue after the workshop as this may prove to be a very innovative method for the restoration of tile mosaic in the future. An off-site display showcasing the final appearance of such biscuits will be exhibited at the workshop.

Reintegration of Islands on Fresco and Brick Imitation Work:

Both fresco wall paintings and brick imitation work follow the same technique of applying paint on wet plaster. After cleaning of the original fresco and brick imitation plaster, a technique known as *aqua sporca* was used to make the plaster look older and aged as it did prior to cleaning. This method involves the preparation of a very diluted mixture of pigments which give the colour of brownish muddy water. The “dirty water” is then applied with a paintbrush in a subtle way to give a background effect. Weathering of the paint and cracking of the plaster has formed disconnected islands in the original design.

Plaster Work:

New plaster has been applied on all exposed brick masonry. According to references, the fresco and brick imitation plaster have been the same historically. Therefore, the same lime plaster resembling the original one in colour and texture was applied on the exposed brick work on fresco panels and brick imitation frames. Incision lines have been made on the frames to suggest the original presence of brick imitation. Uniform joints were marked both horizontally and vertically where the new plaster merges with the original. Large gaps between the original plaster and the wall were also filled with lime plaster. Similarly, exposed bricks on missing tile mosaic panels were covered with lime plaster that resembles the colour and texture of the original tile bodies. These plasters were made using local materials like lime putty, kankar lime, brick dust, river sand and marble powder.

Reconstruction of Filigree, Pigeon House and Cut and Dressed Brick Work:

Two horizontal friezes of filigree work run throughout the Picture Wall with self-replicating geometric patterns. The upper filigree has a *shashpari* (five-pointed star) pattern while the lower one has a swastika pattern. Initially, all the filigree work was cleaned, removing dust and loose mortar inside the cut brick pattern and loose joints were consolidated with mortar. There are many breaks in the friezes which are filled with intervention brickwork probably belonging to the British period. The intervention bricks were removed and the missing filigree sections have been restored to the original design. The pieces of brick tiles were cut according to exact size of the pattern. After dressing of the surface, the brick tiles were carved according to the design. The terracotta pieces were laid accordingly after which the design is filled with tile mosaics.

Many fresco panels on the Picture Wall have pigeon houses in the center. These houses are made of terracotta and tile mosaics and many of them have been damaged severely. A pigeon house was reconstructed on one of the fresco panels in the proto-type area for assessment. The same material and design has been used as the original pigeon house. Cut and dressed brick work was extensively used in the construction of Picture wall. This was a popular craft in the Mughal period where the fine joints between bricks were filled with lime mortar. In this technique, bricks are cut on exact size after which their size is checked and corrected with a gauge. Finally, these bricks are laid in lime mortar on the wall. Many of these original brick tiles were decayed due to salt crystallization and capillary uptake of water. The fragile brick were replaced with new cut brick tiles. The traditional method of cut and dressed brickwork was followed. Filling of all gaps and stabilization has also been done so that a surface could be prepared for a final finish.

Restoration of Pigeon House

Stalactite Work (Ghalib Kari):

For stalactite work, brick structure is plastered after proper surface preparation in varying thickness according to various patterns. When the plaster is almost set, it is carved in with special types of craft tools. In the case of engraved lines, after the application of base and top layer of plaster the lines are engraved according with a sharp edge tool. The surface is then finished with glaze lime plaster.

The lower most part of prototype area (Iwan) has been plastered with stalactite work (Ghalib Kari) according to available evidence of Mughal period. The entire area of Iwan was covered with later additional cement plaster. Before starting the work, cement plaster was removed, exposing the layer of brick tiles in deteriorated condition. Replacement of fragile bricks with cut and dressed brick work has been done on the entire lower part of the prototype area.

View of the Stalactite work before intervention

Stalactite Plaster Work

Restoration of *(Kashi)* Glazed Mosaic Tiles with Historical Techniques:

The technique of glazed ceramics dates back to early Islamic period in the subcontinent. Vast numbers of artifacts in ceramic pottery and toys have been found during archeological excavation on various sites. According to historians, the technique of decorating architectural buildings with glazed mosaic tiles was mainly used in *Kashan Iran*. It inspired the Mughals to make it one of the main decorative elements in Mughal architecture. Lahore Fort Picture Wall portrays variety of geometrical, figurative and floral patterns with glazed mosaic tiles. To study about the technique and material composition scientific method is adopted by the organization to reach the actual traditional techniques of making of glazed tiles. First samples of historical glazed mosaic tiles were sent for laboratory testing and analysis to different building material laboratories in Pakistan and abroad. These tests included XRD/XRF, Petrographic and mineralogical analysis, hardness tests and analysis of other physical properties done both on and off site. Apart from the chemical-physical tests visual investigation and archival data was explored and reviewed with the available resources.

Restoration of Glazed mosaic Tiles:

1. Pigeon House:

The pigeon house is decorated with colored glazed tiles as found in the western and northern side of Picture Wall. The design pattern and choice of color were picked from the adjacent remaining pigeon holes in the Picture wall. The actual colors are matched with the original tiles colors. The glazed tiles used in the historical pigeon house are mix of ceramic body and terracotta base tile, fixed with different techniques of cutting and chiseling. The reconstruction of this pigeon house is done following the original design and proportions.

2. Upper/Lower filigree restoration:

Two horizontal friezes running through Picture wall have been restored with addition of missing carved brick pattern and glazed tiles matching the original color and design.

Upper Filigree with mosaic glazed tiles

3. Lower cornice restoration:

The restoration of lower cornice is done with filling missing and decayed brick tiles with cut and dressed bricks by keeping the original and replacing the glazed mosaic tiles in original color.

Restored Lower Filigree & cornice with mosaic glazed tiles

Excavation:

The objective of the excavation work was to expose and study the original Mughal era floor level around the Picture Wall. For this purpose an exploratory pit was dug out under the selected prototype area so that examine the structure stability, and perform a complete study of the traditional construction techniques that consist of cut and dressed brick work, brick imitation work, and fresco painting underneath wall. These investigations made it possible to analyze the various interventions and changes made to the Picture Wall area during the post-Mughal Era including the British and Sikh Rule.

Now as a part of display, original floor level of Picture Wall which is more than 2 meters below the ground level has been exposed. This will help the wall to dry up as well as expose the whole length and proportion of the Picture Wall.

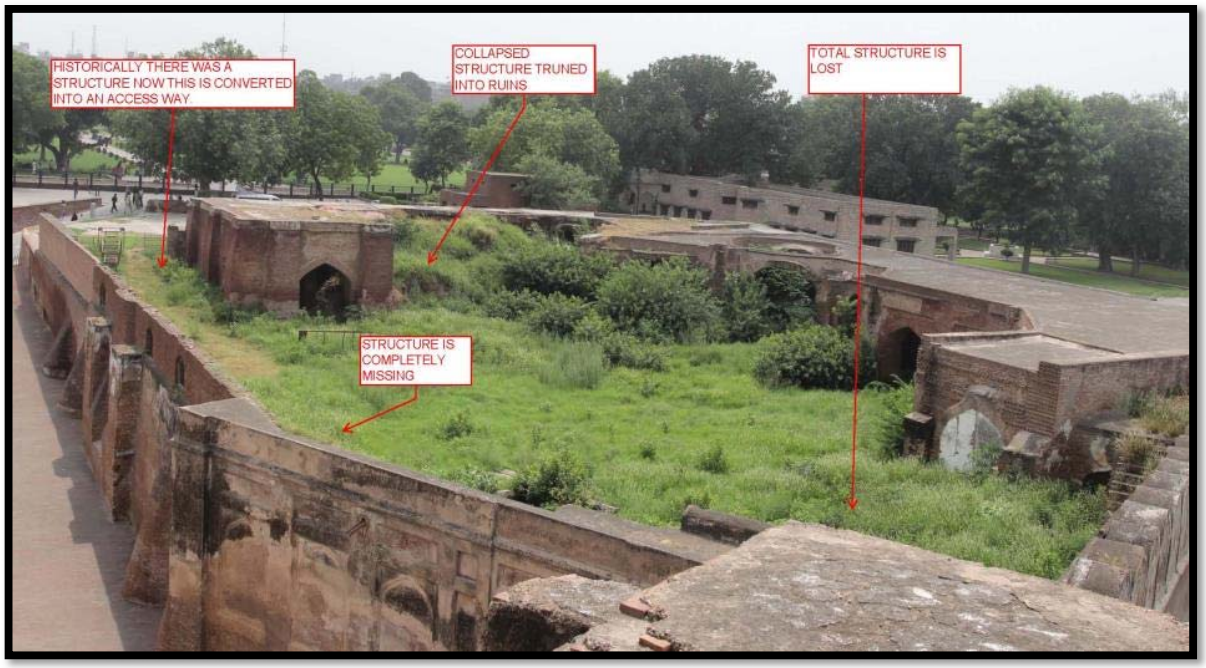
(Left): Barracks from the British era found in the excavation; (Right) Mughal era floor level in the excavation pit

Restoration of Royal Kitchen:

The Royal Kitchen was built around 16th Century A.D. by the *Mughal ruler Shahjehan*. to serve kings / inhabitants of the fort. A caravanserai was also located nearby but no longer exists. It is located in the southwestern corner of the fort. According to historians the ***Mughal rulers*** used this building as the center of all imperial feasts, ***Sikh*** used this complex as food storage.

The following tasks have been completed

- Documentation of Building with Total Station and 3d Scanner
- Monitoring of structural movement & recording of cracks
- Recording of severely undermined structures and conservation proposal
- Soil Investigation
- Exploratory works
- Construction of Retaining wall in surrounding


HISTORICALLY THERE WAS A STRUCTURE NOW THIS IS CONVERTED INTO AN ACCESS WAY.
COLLAPSED STRUCTURE TRUNED INTO RUINS
TOTAL STRUCTURE IS LOST
STRUCTURE IS COMPLETELY MISSING

BAROOD KHANA .

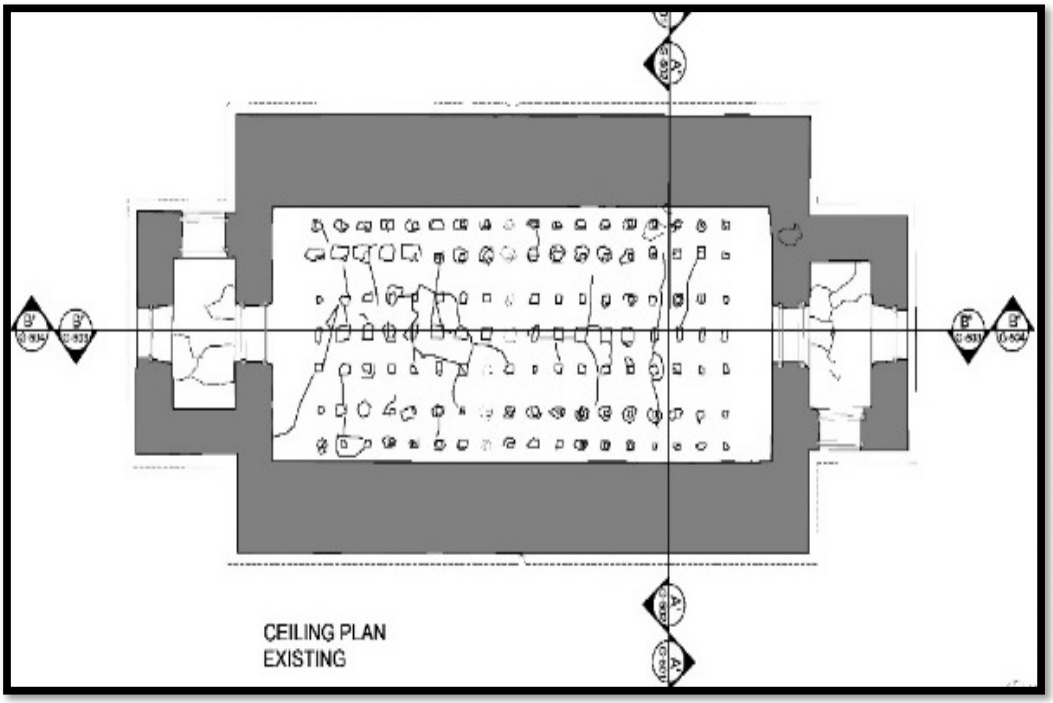
Barrod Khana was built during British era in 1857 according to the plaque laid on the one of the entrance of barood khana. Purpose of this building was to store the weapons. The Barood khana is a single story building located at western side of Lahore Fort near Alamgiri gate and Musammam Darwaza.

The structure of the Barood Khana is built with the brick masonry and lime mortars. During visual inspection the majority of damages found in the form of cracks, bulging in plaster, missing or dismantled brick masonry, missing cornices, damages in wooden doors and ventilators, blackish surface, graffiti internal side and biological growth around structure. Walled City Lahore Authority (WCLA) has acknowledged the importance of the barood khana and has taken the responsibility of sustainable conservation.

The internal dimension of Barood khana are 42’9” x 16’11”. The external dimensions are 49’3” x 29’3”.

Following Task has been completed:

- Architectural and Photographic Documentation of Building
- Structural Analysis
- Design Proposal


CEILING PLAN
EXISTING

WESTERN SUITS

Western suits are located in Jahangir quadrangle in Lahore fort. Built in Jahangir era. Walled City Lahore Authority (WCLA) has acknowledged the importance of the western suits and has taken the responsibility of sustainable conservation.

Structural consolidation:

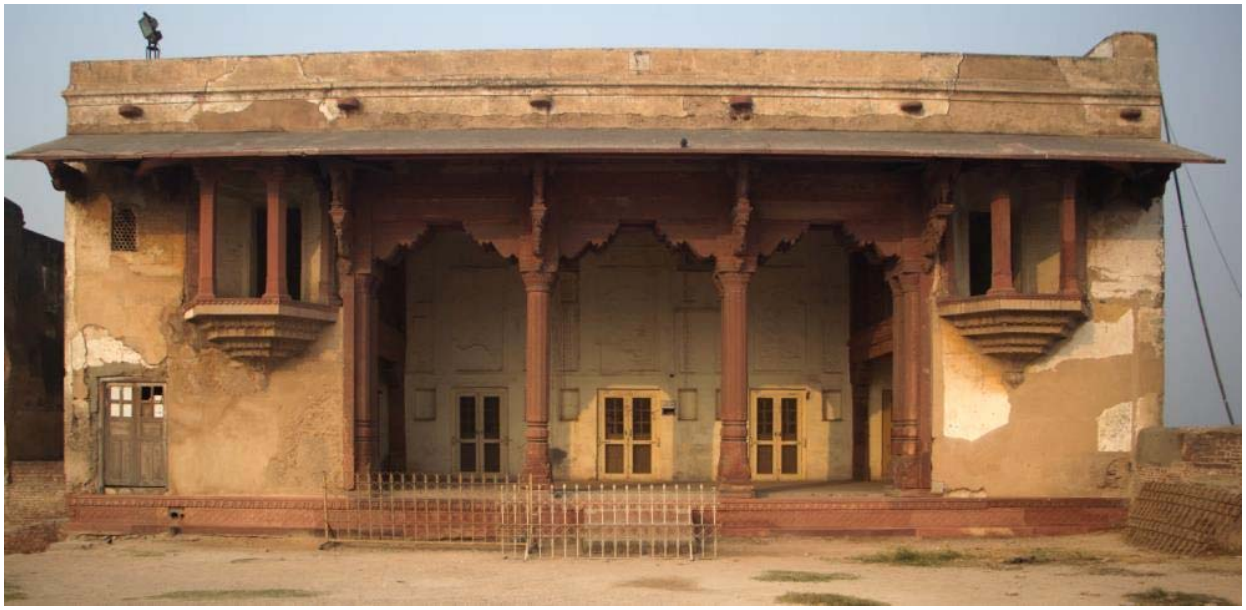
Broken stone to be replaced. Providing and laying flat tile roofing over wooden battens including sealing of joints with mud mortar. Wooden preservation through anti termite chemicals. Provision of doors and windows of deodar wood. Provision for 4" thick gola in lime.

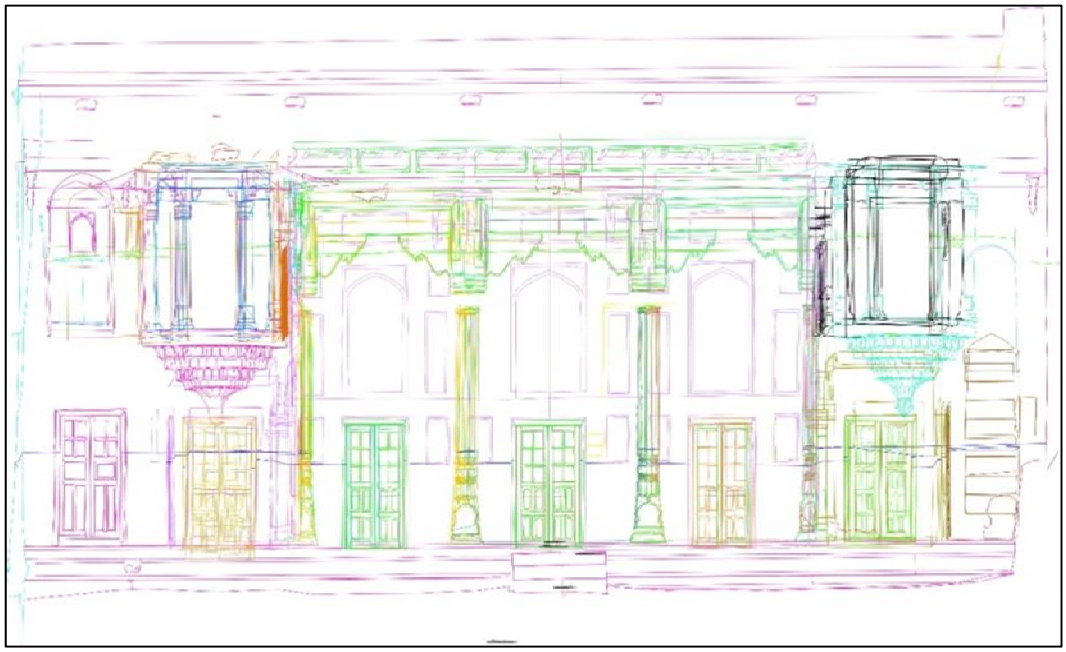
Provision for conserve and consolidation of original components of surface including edging and supporting to subsided portion , pointing masonry etc. Electrification in the basement of old rest house.

Following tasks has been completed:

- Architectural and Photographic Documentation of Building
- Structural Analysis
- Design Proposal

WESTERN SUITS





MAKATIB KHANA

The Maktab Khana is a small cloistered court immediately adjacent to the Moti Masjid. It is a Persian-style compound with pointed-arch arcades and deep iwans at the center of each of the four sides. However, an inscription found above the main entrance records that it was built under the supervision of Ma'mur Khan in 1617-18 and identifies the site as the "Daulat Khana-i-Jahangiri", the "Residence of Jahangir". It is therefore likely that the Maktab Khana is a surviving fragment of a much larger mansion complex serving the Emperor.

Presently Makatib khana is a single story building containing an open courtyard (19mX19m) in the middle of building constructed with brick masonary and lime mortar. Makatib khana is suffering from serious threat and damges, during visual inspectionnthe majority of damges found in the form of cracks, and solmn leaning at northeast corner.

Considering the fact and venerability of the structure, it is important for the stability and prolonging of the structure of the all threats and damges to the structure both at micro and macro scale should be addressed and encountered before transforming structure into worse condition.

Following task has been completed:

- Architectural and Photographic Documentation
- Structural Analysis
- Remedial measure for vegetation growth
- Restoration of Monuments

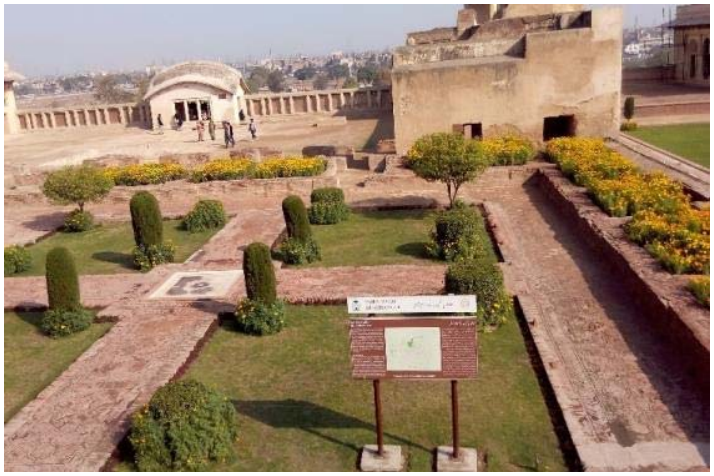
PUBLIC FACILITATION IN LAHORE FORT

The Following Public Facilities has been provided in the Lahore Fort

Public Wash Room

Electric Shutter Bus

IMPROVEMENT OF GARDENS

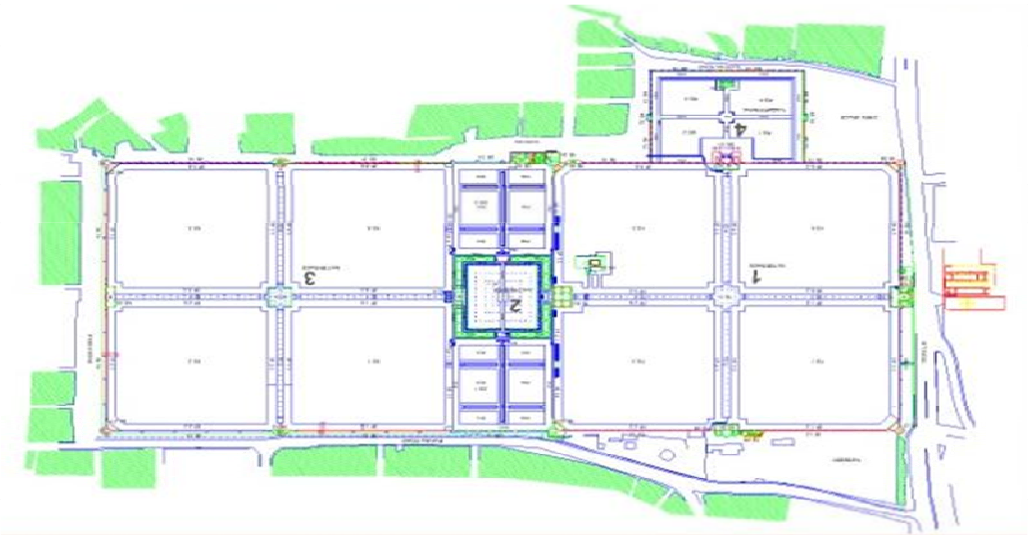


Part-3

SHALAMAR GARDEN

Shalamar Gardens, a marvel of Mughal garden architecture, is one of the greatest gardens in the world, representing of the Islamic concept of Paradise. The Shalamar Gardens built in 1642, is a grand manifestation of the ingenuity and craftsmanship of a group of architects, hydrologists, horticulturists, engineers and master craftsmen. The Emperor Shah Jahan intelligently selected a site to build a garden, naturally-terraced to allow for the complex flowing-water system, with fountains, falls and pools, which were fundamental to a Mughal garden. With the passage of time deteriorations in different parts of the gardens were quite significant. Shalamar Gardens was transferred from Federal Government to Punjab Government in 2004 and since then the Directorate General of Archaeology; Punjab has been doing its level best for its proper upkeep, maintenance and conservation. The Government of the Punjab also approved a major conservation plan for preservation and restoration of Shalamar Gardens" amounting to PKR- 300 million in 2006-7 and works for preservation and restoration of various areas inside the gardens remainedcontinued till 2016. Different parts of the Shalamar Gardens have sufficiently been conserved, restored and stabilized to avoid further decay. In the light of the decisions of the Steering Committee and Technical Committee constituted for the smooth execution of conservation works, the scheme has been revised to incorporate the missing elements for further execution and samehas been approved from the competent forum.

Following preservation and restoration works have executed during the year 2017.



PLAN OF SHALAMAR GARDEN

1. **Preservation and Restoration of Naqqar Khana Complex of Shalamar Gardens, Lahore**

The Naqqar khana Complex is the integral part of the Shalamar Gardens located on the eastern side of the garden. It was used for the all official activities during the presence of Emperor Shah Jahan, as government secretariat. All important announcement and official order were issued from this place. After the completion of the Parking and Public Utility area at the eastern side, entrance of the tourist has been shifted through Naqqar Khana Complex therefore became fist appearance to the visitor. Condition of this pavilion was not upto the desired conservation standards. Therefore a new project to the cost of Rs. 6.154 million ($ 0.057 million) was initiated in the year 2016-17. Under the scheme restoration of decayed plaster, pucca kali and walkways has been conserved. Decayed floor of the Naqqar Khana pavilion has been restored to the original geometrical. Wooden doors at the southern side entrance of the complex and inside have restored. On the eastern exterior side boundary with iron fence has been erected to control encroachment, trespassing. Brick on edge flooring has been laid to control water penetration on the area between the southern perimeter wall and boundary wall. Roofs of the have been water tightened with lime terracing and lawn inside have been developed. After the completion of the project this part of the Garden not only preserved but also upgraded to a presentable look.

	
Before Conservation	**After Conservation**

Fixing of iron grill & Plinth Protection on exterior side of perimeter wall of Naqqar Khana

Before

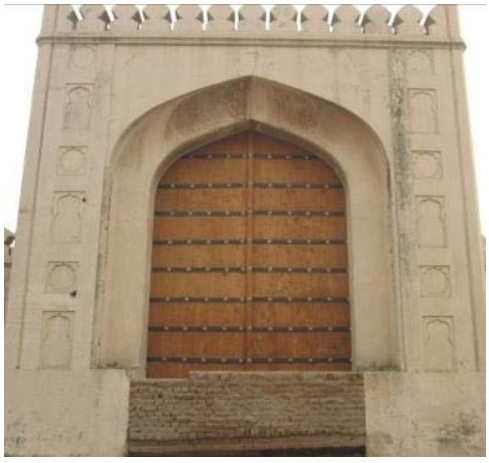
After

Conservation of Lime Plaster of Perimeter Wall of Naqqar Khana

Before Conservation

After Conservation

Conservation of Pavilion of Naqqar Khana Complex	
	
Before Conservation	**After Conservation**

Restoration of Wooden Gate of Naqqar Khana Complex	
	
Before Conservation	**After Conservation**

	
Before Conservation	**After Conservation**

2. Preservation Restoration of Hydraulic Tank of Shalamar Gardens, Lahore

The old hydraulic tank structure is situated on the southern side of the Shalamar Gardens, a complex of brick built sedimentation/ filtration tanks. Water was brought through Shah Nahar (Royal Canal) from the Chamba Hills of Rajpur, presently Madhupur in India, at a distance of over one hundred and fifty kilometers from Lahore. It was planned by Ali Mardan Khan, the Persian Canal engineer of Shah Jhan, and completed By Mulla Ala ul Mulik Tuni an expert in hydrology. At present the system and hydraulic tank is no more functional and remnant of structure are available.

A project amounting to Rs. 6.266 Million was approved and initiated in 2016 to preserve and consolidate the remnants of the Hydraulic Tank.

Major part the project particularly preservation and restoration of remnants of old hydraulic structure has been completed. Structure has been consolidated by underpinning, lime plaster has been restored and roof has been laid with lime terracing to avoid moisture penetration. Plinth protection has been provided around the structure for the restriction of any water penetration to the foundations of the monument. Construction of boundary wall with iron

fence and development of the grassy lawns around monument is pending and will be completed after construction of Orange Line Metro Train track.

Preservation of Hydraulic Tank	
	
Before Conservation	**After Conservation**
	
Before Conservation	**After Conservation**

3. Revision of Scheme for the Preservation and Restoration of Shalamar Gardens

Shalamar Gardens was transferred to Govt. of the Punjab in 2004 by the Federal Government for better upkeep and management. Accordingly, the Directorate General Archaeology, Punjab prepared a PC-1 for the preservation and restoration of Shalamar Gardens at a cost Rs.300 million which was in. 2006 and work started in March, 2007. A Steering Committee under the chairmanship of Chairman P&D Board and a Technical Committee under the chairmanship of Director General Archaeology were also constituted for proper execution of the scheme. During the past 9 years major works, that have been executed to preserve the World Heritage monument, include preservation and restoration of water channels, summer pavilion, Aramgah Shahjahan, Khwabgah building, corner towers, old well and hydraulic structure, dividing wall of 1st and 2nd terrace, perimeter wall, walkways, Moorcroft building and provision of toilet block etc. Red sandstone was imported from India to restore the decayed and missing elements of the different parts of the garden.

After the passage of long time after the approval of the project there was a dire need to review the provisions of the scheme, update rates and item of work to the genuine requirement for preservation and restoration work and other allied component. For the optimal and critical review of the provisions of the schemes a number of meeting of project Technical Committee and Steering Committee were held. Since it was not possible to execute work on old rates and some variation in the items of work, work on the scheme this main project remained suspended in 2016-2017. The revised scheme was finally approved by the Departmental development Sub Committee in May 2017 to the cost of PKR.290.90 Million. In the current financial year PKR. 15.000 million have been allocated for the project and work has been resumed. Work has been stated on the following components of the scheme.

3.1 Preservation and Restoration of Water Channels and Tanks of Middle Terrace

The conservation work includes restoration of decayed plaster, lime terracing and brick on edge flooring of the main tank and water channels of middle terrace of gardens.

3.2 Preservation and Restoration of walkways

The conservation work includes laying of country brick masonry with special size brick tiles, damp proofing with lime concrete, brick on edge floor for walkways and preservation of existing walkway.

3.3 Preservation & Restoration of Summer Pavilion

The work includes conservation and restoration of kankar lime plaster, Pucca Qalai plaster, Tarseem bandi (Decorated wood work) including painting with linseed oil and kankar lime terracing for waterproofing of roof of pavilion.

3.4 Preservation of Stairways

The work includes restoration of special tile brick masonry, kankar lime plaster, coping and terracotta.

4. STEPS TAKEN TO PRESERVE THE OUTSTANDING UNIVERSAL VALUE OF THE PROPERTY

The Government of Punjab had started Lahore Orange Line Metro Train Project to overcome the ever increasing traffic issues in Lahore. The Orange Line Train Project has been designed to overcome the traffic congestion on these two roads and to provide affordable and quick mean of transportation that could save considerable time of the people that they consume in travelling on these roads.

The Government of Punjab is well aware of the importance of the heritage and keep them safe from any negative impact, special study was got conducted and the design was prepared accordingly to evaluate any possible impact of vibration on the historical buildings. For that particular matter the German Standards were used as the key for measurement of vibration impact. Studies conducted by NESPAK and Chinese Engineer confirmed that the vibration would be much less than the permissible limit of 3 mm/sec provided by the German standard DIN 4150-3. Hence there would be no threat to the historical buildings falling near the track of this project.

As far as the World Heritage property is concerned, Orange Line Project would pass south of Shalamar Gardens from a safe distance while Lahore fort is far away from this project. The Government of Punjab awarded contract to a renowned internationally recognized firm to conduct Visual Impact Study which has been completed and submitted to WHC. According to VIA there will be temporary minor visual impacts on the Shalamar Gardens during construction phase that will disappear when construction completed. The visual impact from any location inside the gardens can be minimized by planting high trees and by integrating the colour and material of the Orange Line structure with the surrounding buildings. The visual integrity and the outstanding universal value of the world heritage property will not be impacted by the planned metro construction. In addition, landscape of the area surrounding orange line structure in front of Shalamar Gardens will be decorated with motifs and other similar features. Plants and creepers on the piers will reduce any visual impact. Various other mitigation measures proposed in Visual Impact Assessment and Heritage Impact Assessment reports will be adopted to enhance the landscaping and visual improvement of the area.

The State Party fully realizes the importance of the Outstanding Universal Value (OUV) of the Property. The Orange Line Metro Train Project is one of the major steps taken by the Government of the Punjab to satisfy the need of the growing city of Lahore without compromising the heritage values of the Property. All possible studies were conducted to check any impact of Orange Line Metro Train Project on the World Heritage Property. The data collected through scientific analysis has also proved that there would be no impact on the World Heritage Property that could compromise its Outstanding Universal Value. Furthermore, the studies confirmed that implementation of the project would reduce the vehicular traffic &congestion near the World Heritage Property that would rather have a positive impact in the form of reduction of noise, vibration and air pollution.

Optimum safety measures are being adopted in the light of directions of the Honorable Supreme Court reflected in its decision on 8th December 2017 and the concern of the World Heritage Committee shown in its 41st Session. Sothern wall including corner towers and hydraulic tank of Shalamar Gardens has been thoroughly braced to avoid any accidental effect on the structure during the construction. To avoid damages due to dust and pollution these structures have been covered with dust proof sheets. In the light of the direction of the Supreme Court of Pakistan, the executing agency made all necessary arrangements to ensure that the monuments remain stable and undamaged in all respects during the execution of the Project as specified in the HIA and Study of Control of Vibration, Noise and Foundation undermining

To ensure implementation of additional mitigation and remedial measures as mentioned in vibration analysis, necessary equipment have been installed to record vibration, noise, cracks, settlement and deflection of any part of the monument. A high level Special Committee of Expert has been constituted under the supervision of a retired Judge of Supreme Court, comprising Principal National College of Arts, Chairman Archaeology Department University of the Punjab, Head of Structure Division, Civil Engineering Department University of Engineering and Technology, Lahore and Director General Archaeology, Punjab, to oversee the implementation of the Judgment and directions of the Honourable Supreme Court for making recommendation to undertake measure as may be necessary for the safety of the monuments. After the resumption of construction work of OLMT project, a dedicated technical team of experts comprising of a structural engineer, an experienced archaeologist and conservationist has also been appointed to

periodically inspect the protected monuments to detect any damage or deterioration during execution construction phase to ensure safety of the historical structures / monuments falling on the Orange line project. This team has been empowered to stop the construction work whenever any adverse effect is noted. Furthermore, an independent and experienced Conservation Engineer has been appointed to monitor the Project, both during the construction and operation phases to submit regular reports to the Advisory Committee and the Director General, Archaeology to ensure that the Project as a whole is meeting all technical requirements meant to preserve, protect and conserve the antiquities or protected premises.

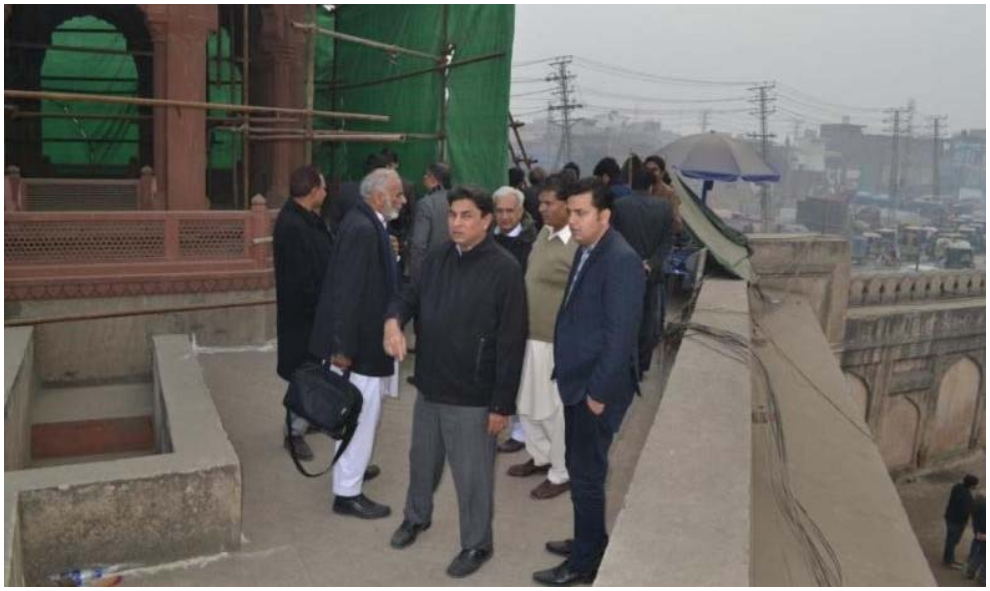
The Government of Punjab has also established a revolving fund of PKR -100.000 million for the preservation and restoration of the monuments falling on the Orange Line project. All the Committees and Technical Experts are constantly monitoring the conditions of the monuments and data of the equipment. It is worth mentioning that results of data show no adverse effect and vibration level is far below the permissible limits and structures are in stable and sound condition.

Safety Measures Adopted during Construction of Orange Line Metro Train

Bracing & Netting / Sheeting Arrangements at Shalamar Gardens

Bracing & Netting / Sheeting Arrangements at Shalamar Gardens

Bracing & Netting / Sheeting Arrangements at Hydraulic Tank



Visit of Advisory Committee at Shalamar Gardens to ensure the Safety Measures during construction of Orange Line Metro Train Track

Equipment Installed at Site for Monitoring