

ACT-FIELD SCHOOL PROJECT REPORTS AND MEMOIRS, I  
CONSTRUCTION ACTIVITIES IN SWAT DISTRICT (2011-2013)  
KHYBER-PAKTHUNKHWA – PAKISTAN

# THE NEW SWAT ARCHAEOLOGICAL MUSEUM

ARCHITECTURAL STUDY, MASTER PLAN AND EXECUTION

IVANO MARATI

CANDIDA MARIA VASSALLO



PAKISTAN-ITALIAN DEBT SWAP PROGRAM

ISIAO ITALIAN ARCHAEOLOGICAL MISSION IN PAKISTAN  
DIRECTORATE OF ARCHAEOLOGY AND MUSEUMS, KP PROVINCE

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**ACT-FIELD SCHOOL PROJECT REPORTS AND MEMOIRS**

**VOLUME I**

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**THE NEW SWAT ARCHAEOLOGICAL MUSEUM  
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**IVANO MARATI AND CANDIDA M. VASSALLO**

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VOLUME I

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EXCAVATIONS AND CONSERVATION ACTIVITIES IN SWAT DISTRICT (2011-2013)  
KHYBER-PAKHTUNKHWA – PAKISTAN. 1

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BIR-KOT-GHWANDAI (BARIKOT)

THE BUDDHIST SITES OF  
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VOLUME III

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Massimo Vidale and others

RESTORATION AND CONSERVATIONS ACTIVITIES  
AT SAIDU SHARIF I AND JAHANABAD

Edited by Luca M. Olivieri





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A PROJECT BY

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*“The Museum is therefore to be considered as the result of a fruitful cooperation between the Department of Archaeology, Government of Pakistan and the Italian Institute for Cultural Relations between Italy and Asia (IsMEO), that aims at revealing the great historical significance of one of Asia’s most important countries with regard to the contribution it has brought to culture, and to the richness of its artistic output.” (Tucci 1963: 319)*

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#### EDITORIAL NOTE

All the photographs and drawings in the present Volume are by I. Marati and C. M. Vassallo if not differently indicated.

## Message

by the Ambassador of Italy to Pakistan

*Archaeological explorations, restoration and conservation of ancient monuments have always represented traditional areas of excellence for Italy. Our Country has promoted worldwide the protection of material and immaterial heritage for the benefit of future generations through bilateral projects and through its participation to international organisations that operate in these fields, such as UNESCO, in which Italy is one of the leading sponsors.*

*In Pakistan, our archaeologists have been operating since 1955, when Giuseppe Tucci established in Swat a permanent mission of the then Italian Institute for Far and Middle East (IsMEO). Thanks to the work of several generations of Italians very relevant sites, ranging from Protohistory to Islamic times, have been excavated and preserved. Amongst the major Italian archaeological projects in Swat, we may remember the Buddhist sacred area of Butkara I, the settlement of Bir-kot-ghwandaj, and the Ghaznavid mosque of Udegram Mosque, the third most ancient in Pakistan.*

*The construction of a new Swat Archaeological Museum in Saidu Sharif, funded by the Italian Cooperation, in the framework of the Pakistani-Italian Debt-for-Development Swap Agreement (PIDSA), offers a further tangible proof of Italy's commitment in contributing to the protection of the legacy of Pakistan's rich past. The project lies within the Archaeology-Community-Tourism (ACT) scheme implemented by the Italian Archaeological Mission (IAM) and Directorate of Archaeology and Museums, Government of Khyber-Pakhtunkhwa, aimed at enhancing and supporting the economic development and the income generating capacity of the Swat Valley communities, providing training and employment to local excavation and restoration workers.*

*Gandharan art is one of the most interesting examples of the*

*meeting of East and West in Eurasia. Gandhara means Pakistan, the cultural fault-line where East meets West, a land of incredible beauty that acts, through its very significant historical legacy, as bridge between Europe and Asia.*

*The reconstruction of the Museum represents an important milestone for the protection of Pakistan's multi-faceted history and a symbol of the strong bonds that unite Italy and Pakistan.*

*In this regard, I would like to congratulate Mr. Marati and Mrs. Vassallo for this beautiful volume that illustrates the elaboration of the project, the design and construction techniques, as well as the technology and materials implied.*

*I would also like to thank the ACT co-directors for their commendable work in promoting and actively over-viewing the project.*

H.E. Adriano Chiodi Cianfarani



## Message

by the Ambassador of Pakistan to Italy

*Pakistan and Italy are proud heirs to ancient civilizations. A shared love for their respective archaeological heritage is but one of the many common attributes which underlines the close friendship between our two peoples. "The New Swat Archaeological Museum" is yet another manifestation of this shared love. I am delighted about the re-opening of the Swat Museum.*

*Swat Archaeological Museum was originally built almost half a century ago with a master plan designed by the Italian architect Vittorio Caroli. Many of the artifacts and antiquities it houses are the result of joint labour of Italian and Pakistani archaeologists. The Museum's reconstruction, following damages sustained in natural and man-made disasters, symbolizes the enduring friendship between Italy and Pakistan. Its re-opening will not only preserve the archaeological treasures of the Swat Valley but also create livelihood opportunities for the local community by enhancing its tourism potential.*

*The Museum's reconstruction was undertaken within the purview of Archaeology-Community-Tourism (ACT) Field School's Project, a project funded by Pakistani Italian Debt Swap Agreement (PIDSA). The Debt Swap agreement has helped finance a number of projects in various areas of Pakistan in the fields of health, education, poverty reduction and sustainable development. Pakistan is grateful for this assistance.*

*I would like to felicitate Ivano Marati and Candida Vassallo, the co-authors of this book and the planners of the Museum, the co-directors of ACT, and all those who have contributed in various and important ways to the rehabilitation of the Swat Archaeological Museum.*

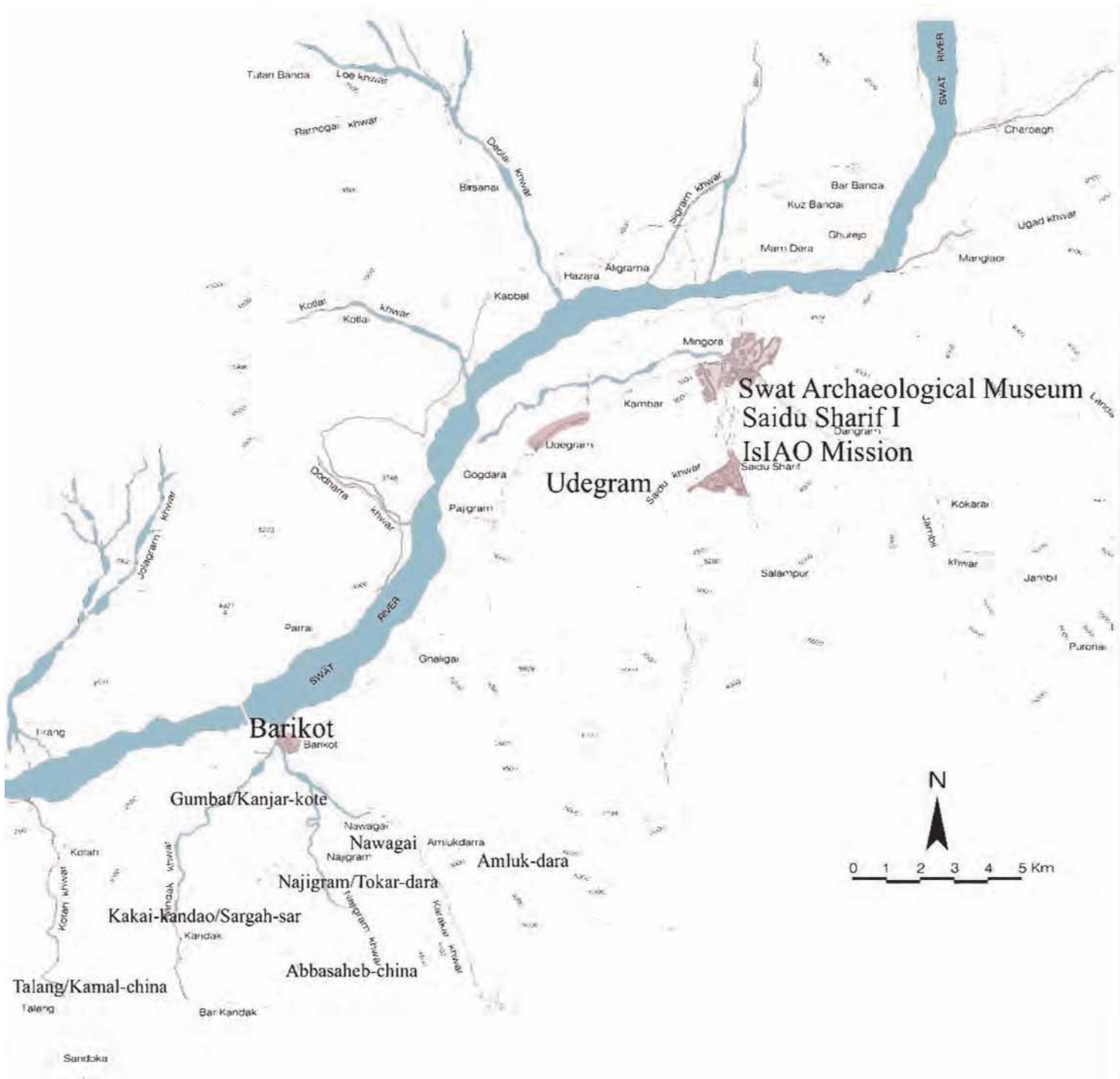
*Wishing the "New Swat Museum" all success in projecting the proud heritage of Pakistan, as well as representing Pakistan-Italian Friendship.*

H.E. Tehmina Janjua



# 0. ACT Field School Project: An Overview\*

*Luca M. Olivieri*





## O.1 The Italian Archaeological Mission in the Swat Valley

The Italian archaeological experience in the Swat Valley, Pakistan, dates back to 1955, when Giuseppe Tucci, the famous Tibetologist and Orientalist, and the greatest Italian scholar of the 20th century in his field, conducted his first visit to the region. Tibet had recently been closed to foreign visitors and therefore G. Tucci turned his attention to the Swat Valley, an important region in Tibetan history, being the birthplace of *sadhu* Padmasambhava, who introduced Buddhism in Tibet in the 7th century. The Italian Archaeological Mission in Pakistan (IAM), founded by G. Tucci as a research unit of the Centre for Excavation and Archaeological Research in Asia of the Institute for the Far and Middle East (IsMEO), began in 1956. The mission obtained important results right from the outset, with the successful digs conducted by Domenico Faccenna in the Buddhist sanctuaries of Butkara I, Panr I and Saidu Sharif I. Soon after, the mission opened up other important excavations, uncovering Protohistoric graveyards, Early- and Late-Historic settlements, and Islamic monuments. Participants in the fieldwork were, among others, Giorgio Gullini, Giorgio Stacul, Massimo Taddei and Umberto Scerrato. In 1984 Pierfrancesco Callieri began exploring Bazira (Barikot), a fortified city dating to Indo-Greek times; in 1986 U. Scerrato discovered the third oldest mosque in Pakistan, founded by a general of Mahmud of Ghazni, in Udegram; in the year 2000 Massimo Vidale, together with the present writer, began compiling an Archaeological Map of the Swat Valley which includes an extremely rich panorama of rock art.

\*In the Introduction all the photographs are by Luca M. Olivieri, Massimo Vidale and Edoardo Loliva (Istituto Superiore per la Conservazione e il Restauro - ISCR). Fig. at p. 2 by L.M. Olivieri; the map at p. 1 is elaborated by Emanuele Morigi after an original by Claudio Faccenna, Silvia D'Acchille and Piero Spagnesi

## 0.2 Archaeology and financial reconversion: A project of cooperation

As early as 2007 the Mission conceived the idea of a comprehensive project focusing on archaeology and the sustainable enhancement of the territory, as well as on job creation. The Mission's standard model of operation was planned to be replicated on a larger scale, and to serve as a model for future enterprises, in Swat and elsewhere.

An important lesson from the Mission's continuous work in the area, even during most difficult times, was that wherever the local communities were engaged in the Mission's work, they managed to defend and preserve their local archaeological sites. This model of sustainable protection proved to be successful even under the most challenging circumstances.

With this in mind, the Mission, together with its counterpart at the time, the Department of Archaeology and Museums (DOAM), (Federal) Government of Pakistan, drafted a new project, named "Archaeology-Community-Tourism Field School" (ACT).

Funding for ACT was obtained through the financial instrument provided by the "Pakistan-Italian Debt Swap Agreement" (PIDSA).

A "debt-swap" is a financial tool that allows a country to exchange its debt for development projects and is one of the most flexible instruments of bilateral cooperation. In 2006 Italy and Pakistan agreed to a debt swap of 100 million US dollars, corresponding to 50% of Pakistan's debts. The other 50% had already been cancelled.

The Development Cooperation of the Italian Ministry of Foreign Affairs considers culture as a direct and indirect tool for economic development. In this respect Italy is in the vanguard, with some very successful integrated "debt-swap" projects, first in Yemen and Egypt, and now in Pakistan. The example of the Swat Valley is particularly emblematic, since tourism (with archaeology playing a very prominent role) has traditionally been its second most important source of income. The objective of the ACT is precisely to propose a model of intervention aimed at contributing to economic revival through the development of archaeological tourism involving local communities. In the so-called source countries, as for example Turkey, Egypt, Afghanistan, Pakistan (and also Italy), etc., where the problems connected to the protection of cultural patrimony are immense, the diffusion of the idea that protection can create jobs and bring about economic growth can alleviate the enormous burden of responsibility shouldered by the government by means of a contribution at the local level.





### 0. 3 "Archaeology from below"

In its initial concept, the project included the acquisition of the archaeological sites, a crucial component for a sustainable protection of the sites. Even if later on this task was entrusted to the government departments, it remains an objective that is to be achieved by the end of the project, since it is a factor necessary to give continuity/sustainability to the initiative.

From 2011 on the responsibility for the protection of the archaeological patrimony has been shifted from the central (Federal) government to the provinces (following the implementation of the 18th Constitutional Amendment or "Devolution"). Even if the UNESCO sites, for example Mohenjo-Daro or Taxila, are still under Federal jurisdiction, the hundreds of Pakistani notified archaeological sites now fall within the purview of the Provinces.

However, the Federal role of custodian of the "National Heritage" is regulated (a) by the Federal Antiquity Act 1975, and (b) by the creation of the Ministry of National Heritage and Integration, which through the DOAM, oversees all archaeological and training activities, especially those involving foreign research bodies.

Following the Devolution, the Directorate of Archaeology and Museums of Khyber-Pakhtunkhwa in Summer 2011 officially became the new Pakistani implementing partner of ACT. As a consequence, the acquisition of the sites is now a responsibility of the KP Archaeological Directorate.

ACT has a two-fold objective - socio-economic and scientific. The scientific



side is mostly based on the programs and targets of the Italian Mission. The socio-economic side involves the participation of local communities. In order to achieve both objectives the project focuses on areas where the Mission has been most continuously and actively involved in important works: Barikot and Udegram.

The scientific part consists of three phases: conservation and restoration, fieldwork, and development. In the sector of conservation and restoration, the project has aimed to make the sites accessible: where necessary, access roads have been built to the sites, and emergency restoration and excavation was begun on the monuments at risk, as in Amluk-dara and Gumbat. Our foremost restoration projects are (a) the main stupa of the Buddhist site of Saidu Sharif I, and (b) the conservation of the colossal rock carving at Jahanabad. And finally, in the field of passive conservation, we have chosen three protohistoric sites of rock art, two painted shelters and a large megalithic monument, the latter decorated with mythical and historical scenes by means of a complicated and fascinating permutation of cup-marks. As far as the excavation is concerned, we followed two main lines of research: the excavation of the city of Barikot, the ancient Bazira of Alexander's historians, and the excavations of the protohistoric graveyards. The entire program takes place in an area measuring slightly less than 50 sqkm. The centrepiece, also from a logistic point of view, of this program is the reconstruction of the Swat Museum, which was damaged during the earthquake of 2005, and by a tragic bomb attack that killed over 70 people in 2008. The total of Italian financial aid amounts to slightly less than 2 million euros (just over 221 million rupees), most of which is being used for the Museum and minor constructions. All the sites in the project touch upon huge scientific issues in the field of archaeology on the Indo-Pakistani subcontinent.



0. 4 The optimization of the cultural patrimony





#### **The graveyards of Udegram and Gogdara 4**

Even if these types of graveyard had already been discovered in the 1960s, they have only recently been the objects of renewed scrutiny. This grave culture (or cultures?) appears to have lasted far longer than expected. New data keeps cropping up from excavations in Chitral (Hindukush), where tombs bearing similar characteristics date to historical times.

The recent excavations led by M. Vidale in the small necropolis of Gogdara 4 and in the larger one of Udegram, thanks to microstratigraphy, have allowed us to reconstruct the surfaces in use around the graves, their phases of reopening, and the phases of abandon. The tombs were dug in artificial terraces and used over and over again. In one phase a wood fence evidently enclosed the tombs, and eventually an earthen mound covered them. The funerary sequence included the exposure of the corpse, the cremation of the bones, and finally the actual burial. In this final phase, a second corpse (almost certainly female) was added to four tombs at Udegram. The preliminary C14 results have given us a dating far older than expected (end of the 2nd millennium), while the presence of an iron artifact could prove to be the oldest artifact ever found on the Indo-Pakistani subcontinent.

#### **The rock art sites at Barikot**

We have documented 52 painted shelters in the mountains south of Barikot, a testimony to the presence of peoples who were marginalized during Buddhist expansions. Among these painted shel-





ters, two (Sargah-sar and Kakai-kandao) represent agricultural cycles without any exterior signs of Buddhism (stupas) or the horse icons, which appear in Swat only during the first millennium. These two shelters were dated to protohistoric times.

Particularly impressive is the shelter of Sargha-sar which resembles a human face. The paintings are located at the base of a huge rock slab in a natural opening (that represents the "mouth"), while two natural cavities create the illusion of two enormous eyes. Our project has also safeguarded a very large monolith covered in hundreds of cup-marks, where the images of a hero armed with a club challenging an anguiform demon have been identified: possibly Indra fighting a water demon, a myth associated with Mount Aornos-Illam, the mountain that dominates the landscape above Barikot.



### The site of Barikot

The ancient Bazira mentioned in the *Historiae* of Alexander the Great was listed among the ten sites most at risk by the magazine *Archaeology* in 2010. While proof of the actual passage of Alexander is still eluding us, what has been uncovered is a large fortified city of the Indo-Greek period (2nd century BCE). The city's walls are still clearly visible, with bastions situated 100 feet apart, a large built-up





area and the acropolis. The site, already inhabited in the 2nd millennium BCE, continued to thrive until relatively recent times (a Brahmanic temple dated to the 7th century CE was excavated on the acropolis). Unfortunately, the site is currently at risk due to the encroachment of the modern village. ACT has placed under protection about one hectare of the archaeological site inside the south-west corner of the city, initiating a program of extensive excavation aimed at uncovering the late urban layout, as it appeared at the end of the Kushana empire when the city was abandoned (mid-3rd century CE). This new chronological data (confirmed by C14 analysis) may change what we know about the history of the Kushana empire and urbanization in ancient India.

### **Buddhist sanctuaries in the Barikot area:**

#### **Gumbat and Amluk-dara**

The area around Barikot contains many Buddhist sanctuaries, whose remains, even if heavily looted, still dominate a unique archaeological landscape. The great sanctuary of Gumbat, the only double-domed Gandharan monument in existence, was in danger of collapsing. The project, besides offering guidelines for preliminary restoration (with a "light" technique consisting of partial dry-wall masonry reconstruction) secured the area and allowed a partial excavation of the stupa terrace to be carried out. C14 analysis has revealed that the double-domed sanctuary was erected no later than the 2nd

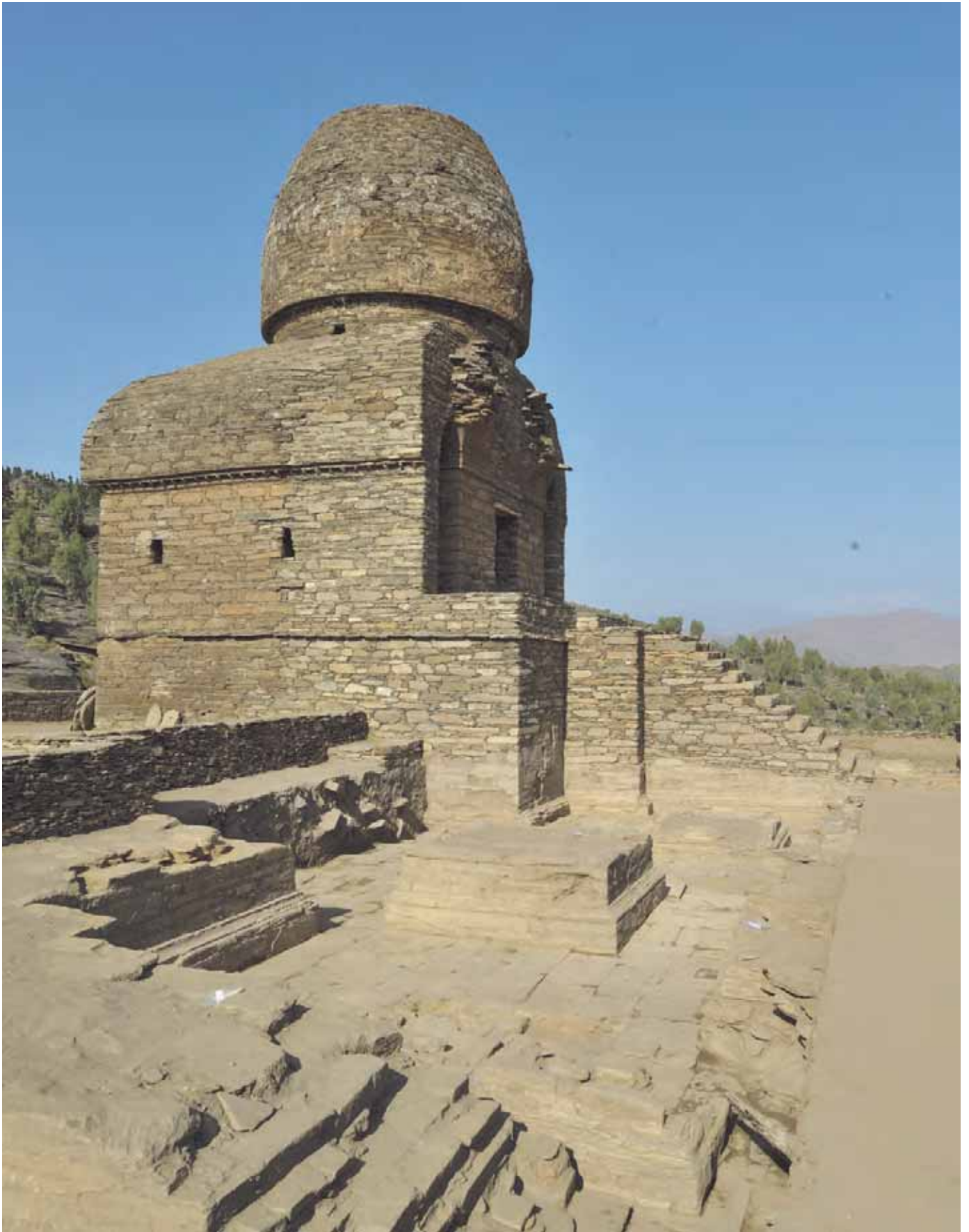


century CE, and that the sacred area, dominated by three surrounding large sanctuaries, remained in use until relatively late times. During this same late phase (5th-8th centuries CE), the great stupa of Amluk-dara, the major monument of the Swat Valley, underwent a series of reconstructions contemporary with the great stupas of the Kabul valley, marked, like the one at Amluk-dara, by huge frontal niches.

### **The Buddhist sanctuary of Saidu Sharif I**

The sacred area with its monastery was excavated during the 1970s and 1980s by D. Faccenna and P. Callieri. The stupa terrace was in a state of relative neglect, when, resuming an old project, we began the restoration of the podium and the staircase of the main stupa. In the current project we are training a new body of specialized workers under the supervision of Giuseppe Morganti and Francesco Martore and with the collaboration of Fabio Colombo. The prime materials used are all traditional to the local material culture: phyllite slabs, clay, straw: we are aiming here to achieve a low cost sustainable model of operation.











### The Buddha of Jahanabad

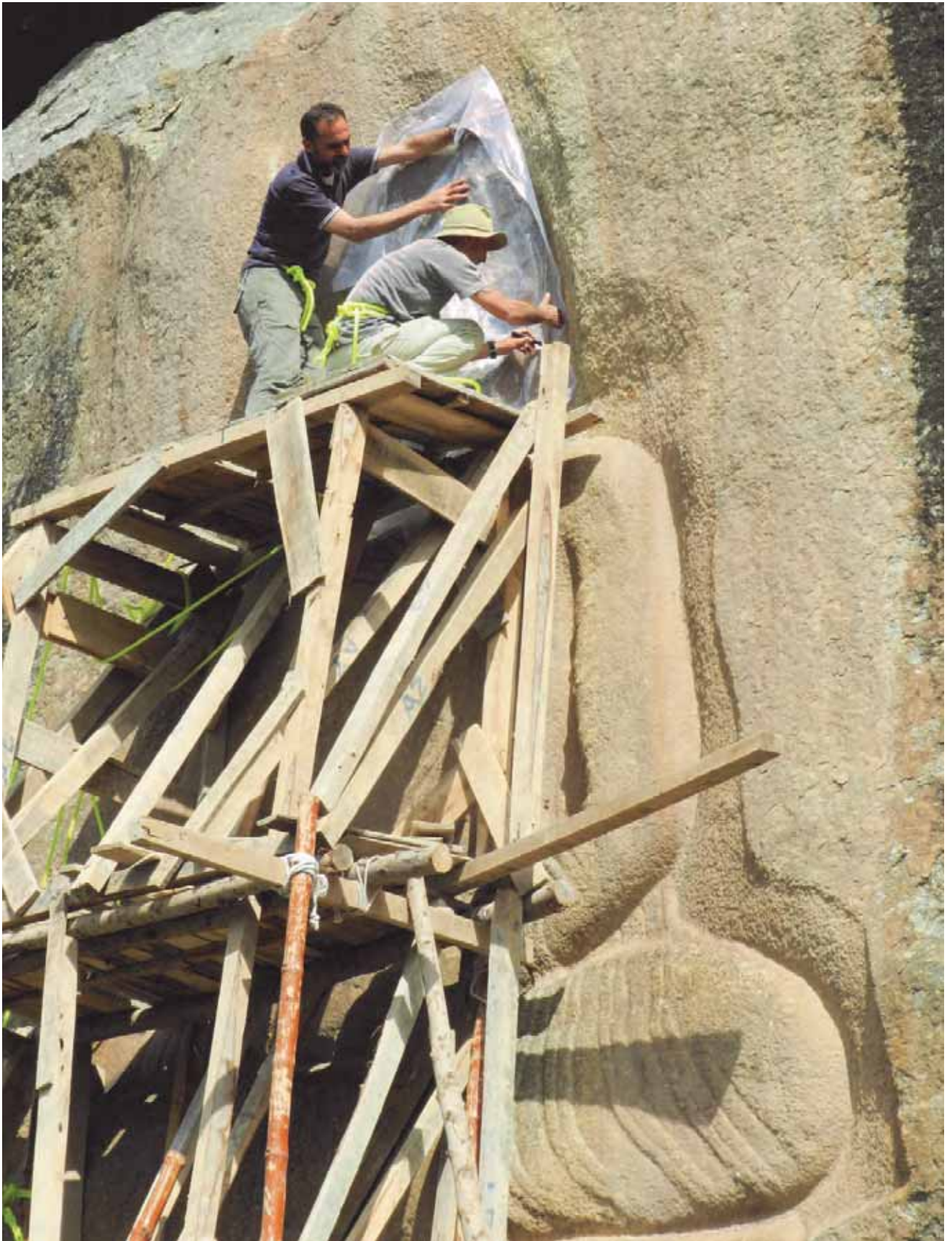
What happened at Jahanabad is well known: in 2007 insurgents tried to destroy the gigantic statue with explosives. The face of the statue was irreparably damaged.

The sculpture of Jahanabad is the largest of the hundreds of late-Buddhist rock reliefs in the Swat Valley (7th-8th centuries CE) documented so far. Anna Filigenzi will soon be publishing its complete *corpus*. At Jahanabad we had the opportunity to start a specialized field school for a small group of workers who had already received some training at Saidu Sharif. Under the supervision of F. Colombo the workers cleaned up the sculpture and stabilized its rock wall, and subsequently “patched up” the wound created by the explosion. The sculpture was carved following a precise perspective illusion, which allows it to be perceived as a well proportioned figure when seen from below, while its head is 1.60 m high, approximately a third of the total height. These characteristics, together with the scarcity of available fragments, have so far not allowed a reconstruction of the volume of the face. The latter step that will be attempted after a 3D scan of the sculpture, is scheduled to be performed shortly.

(Revision by Ian McGilvray)



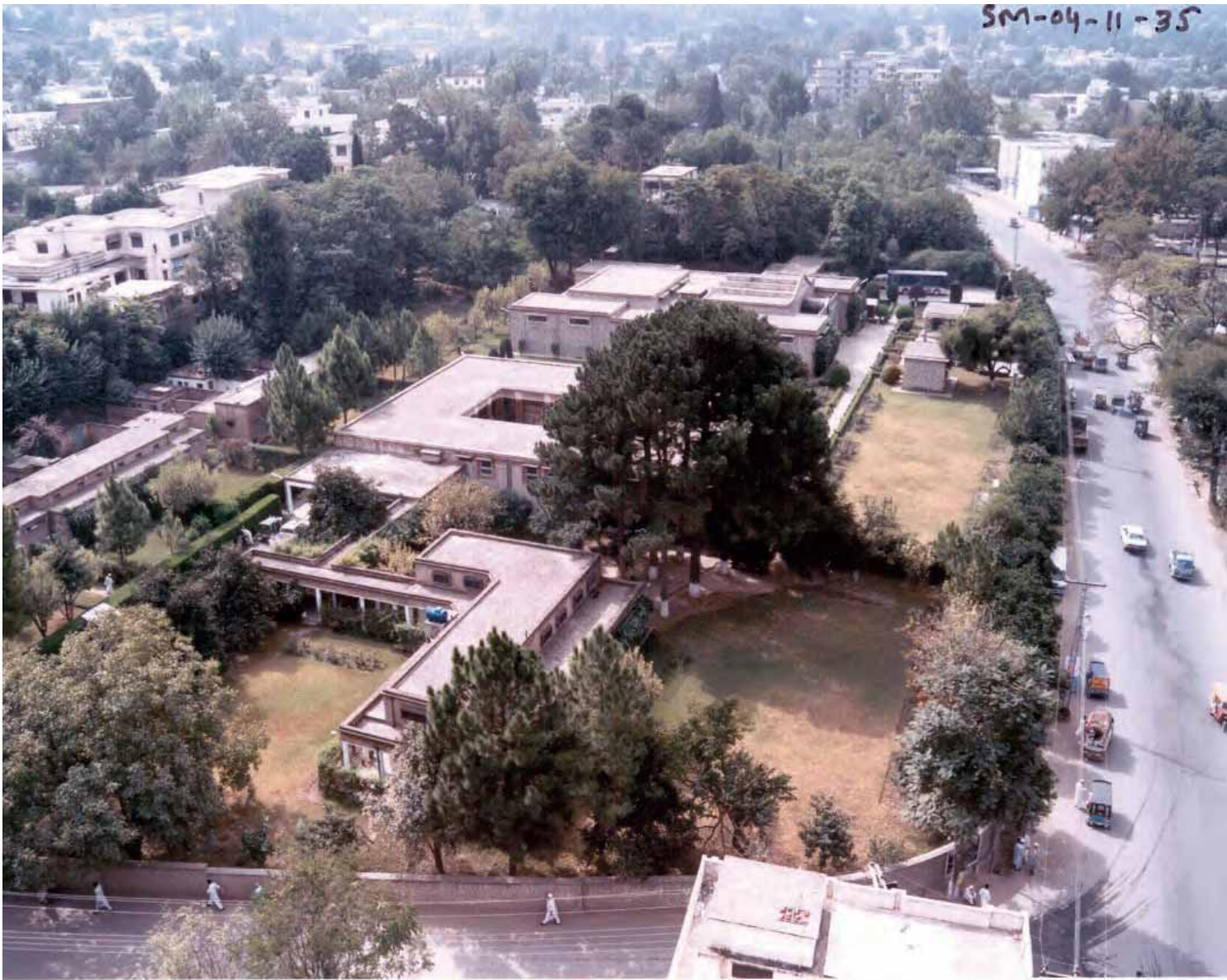








# 1. Architecture of the 50s in Saidu Sharif and the Swat Archaeological Museum





Allah-o-Akbar Masjid in Saidu Sharif was constructed in 1944, during the last years of the Badshah Saheb rule. The Mosque is an excellent example of Islamic religious architecture, and it is still in use. The façade, enriched by Islamic decorations, is characterized by a veranda, marked with three powerful pillars topped with *altane* on the roof, and a Minaret on the left side.

The Swat Archaeological Museum is located in the middle of an urban environment that for the past century has undergone great transformations. Until the end of the 60s the edifices built in Saidu Sharif were based on good principles of construction, partially influenced by the post-rationalist architectures that from the 1940s on took hold gradually from East Africa to the shores of the Sub-Continent. During the following 50 years this homogenous and pleasant environment, here as in other developing countries, deteriorated gradually, due to a chaotic and unplanned expansion of the major centres and villages.

The end of the 50s and the 60s were characterized by the proliferation of architecturally important new public buildings in Pakistan, particularly in the new capital Islamabad. While the historical city of Rawalpindi was still strongly connected with the local traditional architecture, with its strong neo-gothic elements typical of the Anglo-Indian style and functional elements in the East African style (particularly in the warehouses and commercial malls), in the new capital, that emerged close to Rawalpindi, there was a convergence of the rationalist schools inspired by Le Corbusier with his architectural culture, born from the ashes of World War II, and his technologies and utopies<sup>1</sup>. All principal edifices of the



## 1. Architecture of the 50s in Saidu Sharif and Swat Archaeological Museum

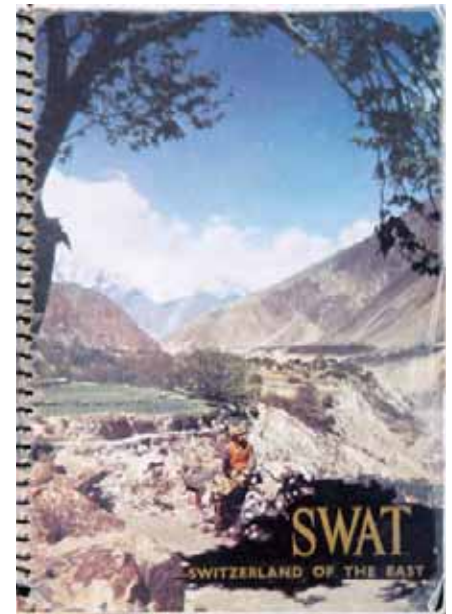
earlier Islamabad were designed and built by foreign firms following projects designed by architects of international fame<sup>2</sup>. They created functional and modern structures, giving new interpretation to the influx of local traditional styles, and inserting them in a new modern and functional Urban Plan, designed by the Greek architect and urban planner, Constantinos A. Doxiadis<sup>3</sup>. The modern architectural style created by the massive introduction of European aesthetic forms combined with the influx of the local Islamic-Saudi style produced an architectonic hybrid that may be defined as “the Pakistan period”<sup>4</sup>.

### 1. 1 Swat: Architecture in the 50s \*

In the Swat State the architectural and urban style of the 40s and 50s may be defined as involuntary eclecticism, mostly thanks to the personal contribution of Major General Miangul Muhammad Abdul Haq Jehanzeb, the last Wali of the State, who reigned from 1949 until the fusion with Pakistan in 1969<sup>5</sup>.

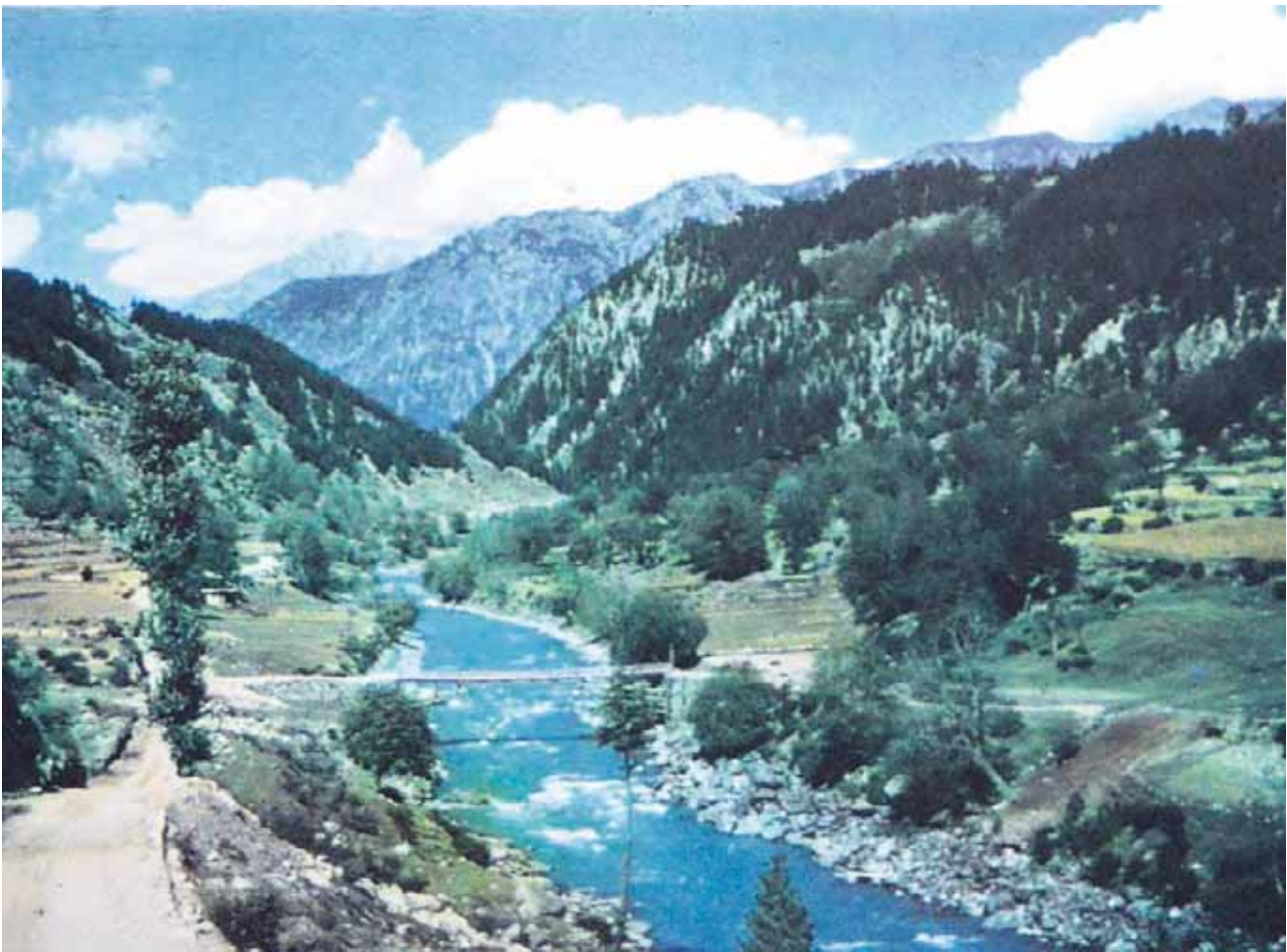
In spite of strong and progressive politics adopted by his father Badshah Saheb, the State was still characterized by an ingrained feudalism that the Wali attempted to change<sup>6</sup> (Barth 1985: 111). The modern Swat State wanted to reach an equitable and shared cultural and economic wealth, optimizing its natural resources as well as the archaeological-cultural resources offered by its strategic mountainous geographical position. Every political choice pointed toward a development of the urban and architectural sector, with its infrastructures, and a development of its cultural resources and tourism, as well as education and medical care in the context of a modern political and administrative framework.

Under the government of the last Wali, were introduced strict urbanistic regulations, matching the then current best practices, with precise architectural and technical specifications for public and private buildings. The purpose of these regulations was to avoid any random building and to achieve an armonious urban development, integrated with the State’s natural resources and the



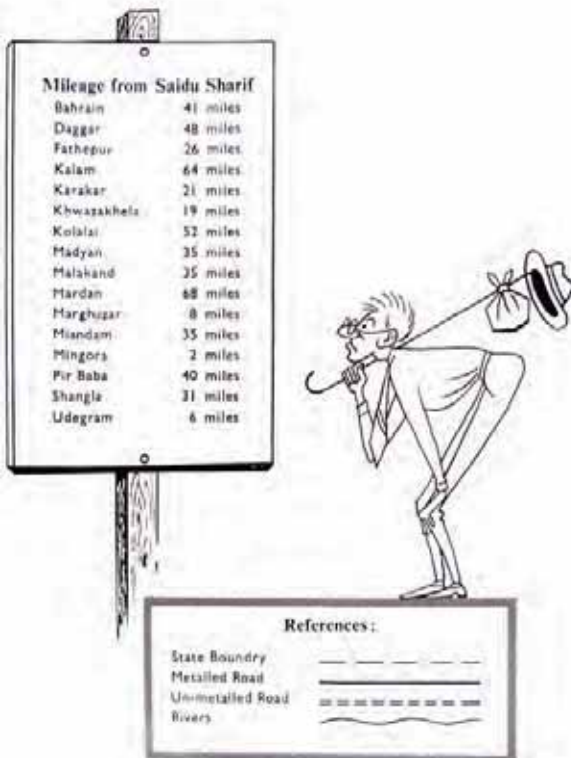
\*Illustration of pp. 19-21, 26 are from Gentley 1963





use of local materials. For these reasons, the Wali himself vetted and approved every architectural and technical design, the tender documents and every contract agreement related to building edifices and infrastructures.

Particular attention was given to the relationship between built up spaces and green areas. This was designed carefully in order to create a pleasant urban environment. The construction quality was high, in both infrastructures and edifices, be it public or private. The architectural specifications were quite meticulous on the design of plans and elevations, prospects and sections. The symmetrical and regular plan was also appropriate for the realization of antiseismic structures as well as for an adequate spatial distribution. Plain prospects were preferred for residential buildings, distributed in a discreet and homogenous complex, where the public buildings, located exclusively alongside the main road, were immediately identifiable thanks to regular and symmetrical monumental proportions. Traditional elements were freely used, such as coupled columns, entablatures, sunshade elements, and tympana. Inside the buildings spaces distributed at different levels were interconnected by stairwais usually located in the center or at both sides.





## 1. Architecture of the 50s in Saidu Sharif and Swat Archaeological Museum



Technical specifications both for technologies and construction materials were the following:

- foundations: lime and aggregate, stone or brick masonry;
- damp proof course (D.P.C.): reinforced concrete (R.C.);
- elevations: bricks or stone wall;
- roofs: reinforced brick concrete (R.B.C.) (1:1 ½:3 with brick laid in between steel mesh) or in corrugated galvanized iron sheet (C.G.I.) over wooded trusses in snow bound areas;
- floors: 2" thick of plain cement concrete (P.C.C.) (1:2:4) topping over lean concrete of lime and aggregate;
- doors and windows: deodar or sheesham wood for door and windows.

(Personal communication by Fazal Raziq, who was in 1961-1969 assistant engineer in the Civil Works Department of the Swat State).

Thanks to the implementation of these "Urbanistic Regulations" and good construction practices the twin towns of Saidu Sharif, the capital city of the Swat, and Mingora (the major trade center), began to develop a complete and balanced urban order. In a matter of a few years Swat achieved a touristic development that was unthinkable for the times.

In order to promote a structured and continuous cultural and touristic development, the Wali invested natural and archaeological resources in the Swat Valley<sup>7</sup>. To encourage tourism,



Serena Hotel is located in the center of Saidu Sharif. The main edifice, constructed under the Wali's reign as Residence for a Wazir (Minister), presents an elegant colonial style with refined ornaments in each of its elements, consisting of a veranda and a courtyard with an inlaid wooden arcade. It is situated on six acres of a lush park, where at a later date other blocks in a more modern style were built. At present the edifice is under restoration.

accommodation facilities were realized with the help of loans granted from the Wali, reaching, in only 20 years, a total of 39 resthouses and hotels from the original two (Rome 2008: 245). In 1963 a detailed and handy touristic guide was published by the State (Gentley 1963). During the same period, important hotels were built or restructured from other edifices; among the latter it should be mentioned the Swat Hotel (today the Swat Serena Hotel) and the White Palace Hotel. Among the former, there is the project realized only much later of the Malam-jabba Ski Resort. In 1955 the Wali initiated a program of valorization of the Swat archaeological heritage allowing G. Tucci and his Italian Institute for



## 1. Architecture of the 50s in Saidu Sharif and Swat Archaeological Museum



Middle and Far East (IsMEO) to open the Italian Archaeological Mission (IAM). The IAM, in collaboration with the Department of Archaeology and Museums, Government of Pakistan (DOAM), began the excavations in the archaeological sites of Ora (Udegram), and in the Buddhist shrines in the Mingora Valley: Butkara I, Panr I and Saidu Sharif I. The Wali's role was a determinant factor for the beginning and the continuation of the IAM activities until 1969, after the Swat State was merged into Pakistan. (Olivieri 2009: 23-4; 26). A double-bungalow in Saidu Sharif was allocated as office, library, laboratories and lodgings of the IAM, with an annexed double-storehouse (*godown*) purposely built by the State to store the archaeological artifacts. The building, restored by ACT in 2012, is still used by the IAM, which has maintained over the years the original architectural features and their pleasant retro atmosphere. Presently, the building houses a rich and updated library specialized in archaeology and fine arts of the Sub-Continent, besides a unique study collection of over one hundred thousand potsherds from Neolithic to Islamic time. The building, besides its collections, it is a historical place in itself, as it houses archival documents and furnitures of the Tucci's time. The IAM twin-bungalows, with their library and collections, have been (and still are) a key-point for the study of the Swat and Gandharan archaeology for four generations of scholars and students.

In 1956 the first nucleus of the Swat Museum's collection was housed in the Jahanzeb College. In 1959, the Wali built the Museum's edifice in Saidu Sharif, in the same compound where the Dar al-'ulum was located, in order to keep his private collection and

The IAM headquarters in Saidu Sharif (see figs. In this page) consists of two rectangular blocks, one at the front for lodgings and offices, and the other in the back as a storehouse. There are also two gardens, one at the front and the other between the two blocks. The façade of the main block is defined by the veranda, with four single pillars and a double pillar at each corner, and it is covered by a flat roof. The storehouse has pillars, and shelves to catalogue and house the archaeological artifacts.





The Hostel Building is situated not far from the main Mingora-Saidu Sharif road, in front of the Swat Archaeological Museum. The construction was interrupted in 1956 and never completed, has a regular and symmetrical plan with one central block connected to two lateral blocks.

the Gandharan artifacts collected by IAM.

The State of Swat gave an extreme importance to the diffusion of modern education even during the 20s<sup>8</sup>, under Badshah Saheb and in particular during the Wali's government<sup>9</sup>, when a great number of schools<sup>10</sup> and public cultural centers were built, including libraries and a conference hall, still representing good examples of functional architecture to this day.

The edifices presented a regular and symmetrical plan, and had stairways at the center or at the sides in a functional spacial flow, in consideration of the large number of students that attended the schools. The monumental façades represented the power of culture, and were realized with symmetrical geometries and traditional elements like coupled columns and sunshades over the verandas, a simple trabeation and a tympanum that usually featured the Swat State's symbol (a turreted bastion), the name and function of the edifice and the year of construction.

Another important issue was the realization of official residences and representative buildings. Even if they were supposed to represent the Mianguls' power in the State, their dimensions were modest, compared with the residences in other Princely States. If in these latter ones only private residences flaunted architectural splendor while public buildings were kept modest and non-descript, one of the most important characteristics of the Swat State was exactly to have channeled financial and aesthetic resources toward public buildings, perhaps following the example, certainly not ignored, of the modern Turkey, and other Islamic States.

The Wali also introduced Health Services, providing everyone with free health facilities and building several hospitals



The Jahanzeb College was constructed between 1951 and 1954, on the main road that connects Mingora to Saidu Sharif. The plan of the building is in the shape of an "E" (for "Education"). The two main floors were completed in 1951, while the third floor and a separate science block were added later. The College contains a well stocked library and a main hall used as a conference hall for the entire community. At a later time other buildings were added to the same compound, showing different architectural styles.



## 1. Architecture of the 50s in Saidu Sharif and Swat Archaeological Museum



The monumental Wadudia Hall was constructed to provide an appropriate conference hall for the communities of the entire region. It was completed in 1969, it is still in use, and it is probably the most characteristic building of the Swat region. The rectangular plan is composed by front and back blocks. The front block is developed on two levels, with a third level at the left side added at a later date. The back block, consisting of only the ground floor, has a conference hall with a lateral veranda, and it is connected to the front block. The entrance is directly connected to the main hall in which is located a formal stairway in white marble, that brings to the Conference Hall. This building presents a monumental façade whose shape recalls the main entrance of Convocation Hall of the Peshawar University built in 1953 (below: photo by L.M. Olivieri).





in the Swat State. In 1968 there were 16 hospitals and 45 dispensaries.

Like in all modern cities, a fundamental element for economic and cultural development has been the realization of infrastructures that greatly improved the connection of Swat with the rest of the country. The road network initiated by the Wali's father, Badshah Saheb, was extended and improved. In 1968 there were 600 miles of roads, of which 116 miles were metalled and the rest unmetalled<sup>11</sup>. There were 500 *pukkha* (excellent) bridges on these roads, including four big bridges across the Swat River, at Barikot, Mingora, Khwaza Khela and Madyan. The fifth one was Bagh Dherai, also called Pul Dherai. Continuing with the initiative started by his father, the Wali established a separate unit whose only task was the roads' maintenance, above and beyond the department responsible for the supervision of new roads and bridges (Rome 2008: 240, 241)<sup>12</sup>. The Wali very often supervised the building of the roads and bridges in person, as he had done with the building of the edifices, so that he could ensure a consistent good quality of the project.

## 1. 2 Swat Museum: A History

The Swat Archaeological Museum's compound is located at the centre of the rich archaeological territory of Malakand Division, on the main road Mingora-Saidu Sharif, at approximately 1 km from Mingora. The compound consists of the Museum's building, the Re-



## 1. Architecture of the 50s in Saidu Sharif and Swat Archaeological Museum

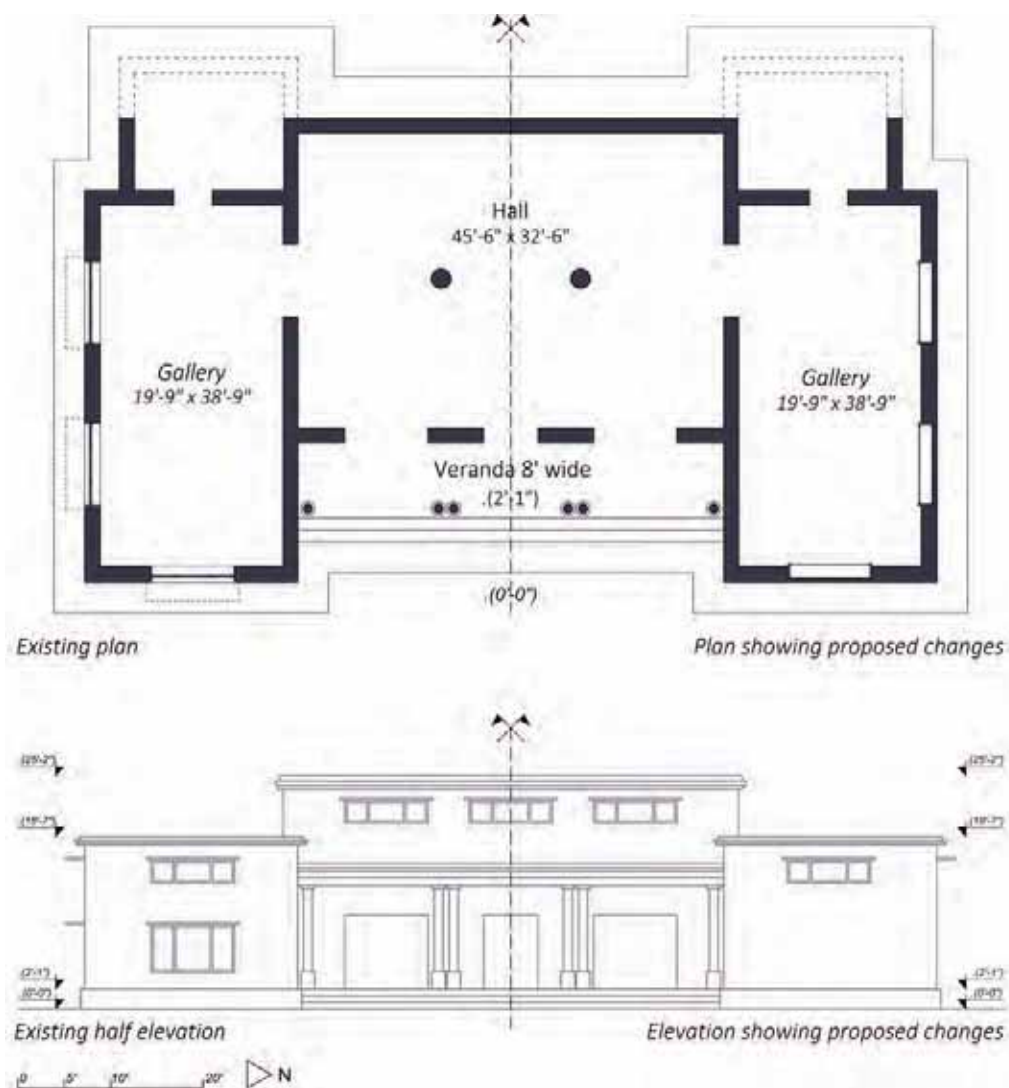
serve Collection storage building, the offices, a guesthouse, the living quarters and minor buildings, for a total of about 120,000 sqm.

Beginning from the first IsMEO expedition of 1956, and until the first half of the 1960s, the IAM, in cooperation with DOAM, carried out the archaeological excavations of Ora, Udegram and in the Buddhist shrines of the Mingora Valley: Butkara I, Panr I and Saidu Sharif I. Over the following years a great quantity of artifacts was unearthed and therefore there was a need for a place in which the artifacts could be stored, catalogued and exhibited in an appropriate way. For this reason a room at the Jehanzeb College in Saidu Sharif was initially allocated as a Museum, and a professor was selected as curator<sup>13</sup>.

In 1958 the Wali pointed out to the Political Agent (Malakand Agency) that the archaeological finds excavated by the IAM were too many and too valuable to be stored in a single room (official letter to the Malakand Political Agent Saadullah Khan, quoted in Tanweer 2011: 43). Clearly there was a need for a proper Museum. G. Tucci presented the project to F. A. Khan, Director General of the DOAM; the preliminary plans and designs for the Museum were realized by arch. Vittorio Caroli (*ibid.*). A year later the Wali Sahib ordered the building of an edifice to be used as Museum, and appointed arch. V. Caroli for its design. The new Museum would house his private collection and the Gandharan artifacts collected by IAM. His aim was to preserve for future generations the Swat rich archaeological heritage.

In 1961, the DOAM acquired the edifices of the Museum and of the Dar al-`ulum, both located in the same compound, at the cost of Rs 98,000. Both buildings were modified according to the approved plan (Khan, Khan 1997: 17).

The new Museum project called for the boarding up of the windows located at the lower part of the galleries, in order to add a greater number of showcases for the new exhibits of its ever growing number of artifacts<sup>14</sup>. The Dar al-`ulum, formerly an Islamic Institute, was



The building, with his symmetrical plan, consisted of a central hall with a veranda, recessed from the twin lateral galleries, both of which had a small room at its rear, used as office and store-rooms. Volumetrically, the central part of the building was taller than the lateral parts, to delineate the greater importance of the hall, as well as to throw light on the inner space. The façade was regular and symmetrical: the central volume presented a six-column veranda on its lower part, and three windows on its upper part. Two twin columns delineated the principal entrance. On the two sides the galleries jutted out from

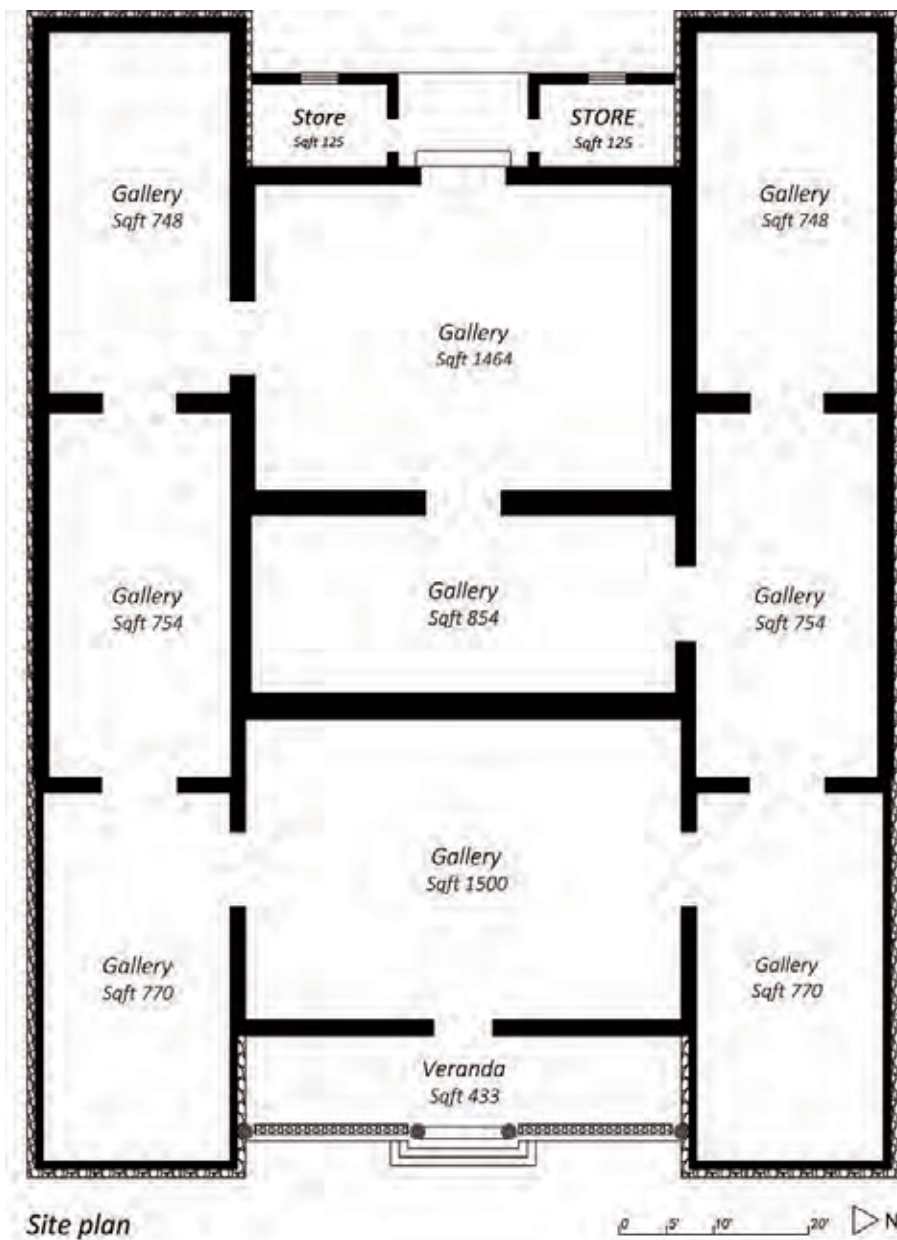
converted into a Reserve Collection (storage building)<sup>15</sup>. The new project saw also the construction of two blocks, one for the Curator's office and the other for the library, overlooking the garden in front of the Museum.

On November 10th 1963 the renovated Museum was inaugurated. The renovated Museum was inaugurated on November 10th 1963 by Field Marshal Muhammad Ayub Khan, the then President of Pakistan (Khan 1997: 18).

In 1967 the two smaller rooms (office and store rooms) located in the back of the Museum were demolished and six new galleries were built in their place. At this time the Museum covered about 855 sqmt (9,206 sqft). The galleries followed the Museum's style and housed the ever growing number of artifacts discovered by IAM and DOAM in the Swat area.

Shortly after Inayat-ur-Rahman, the first curator of the Museum,

## 1. Architecture of the 50s in Saidu Sharif and Swat Archaeological Museum



and Nazir Ahmad Khan allotted some space to the exhibits of ethnological materials collected in remote areas of Swat, Dir and Chitral. Consequently the character of the Museum saw a modification, from Archaeological Site Museum to Archaeological and Ethnological Museum (Khan 1997: 18).

The 70s and the 80s saw archaeological and ethnographic researches conducted independently from DOAM, but in cooperation with other institutions (i.e. IAM and various Italian Universities; University of Peshawar). The newly discovered materials, archaeological and ethnographic, were added to the Museum's exhibits thus enriching the collections and expanding the scope of research and study.

In 1992 the Government of Japan offered a grant-in-aid for the realiza-

tion of the central part, presenting two lines of superimposed windows.

The edifice, basically, was an unreinforced brick masonry structure, including foundations, with a R.B.C. roof and R.C. beams. Furthermore, two columns at the center of the hall held up the R.C. beams. The cladding of the exterior walls consisted of random rubble limestone masonry (source: National Archives of Pakistan).



In 1979 the Museum façade was designed anew and the central part saw a total make over with a confused combination of different styles arranged in a symmetrical design<sup>16</sup>. The veranda was closed with a stone diaper masonry wall, citing two different building techniques discovered in Buddhist structures in Taxila<sup>17</sup>. The façade also presented two carinated Gandharan niches. The main entrance was marked by a *torana*-like pointed arch held by two columns with a double capital decorated with water leaves. Over the overhanging wall topped with *vedika*-like railing and underlined by a pearl-and-bead row, a tympanum was built, held back from the wall, that defined the central part of the edifice. A barrel vault was built over the pointed arch that, contrary to its proper building techniques, was resting directly on the flat roof rather than on the side walls<sup>18</sup>.

tion of a new exhibit in the Museum under the care of M. Ashraf Khan, then Curator of the Museum, and in cooperation with the Messrs Sumitomo Corporation of Tokyo and DOAM officers. The Museum's exhibits were organized anew under new directives: as an example the Gandharan collection was no longer organized according to the sites of discovery, but all the finds were reorganized in a biographical reconstruction of the life of the Buddha.

On February 10th 1994 the Museum was formally reopened by Major General (Retd.) Naseerullah Khan Babar, then Interior Minister Government of Pakistan (Khan 1999: 4).

Over the years the Museum' structure, because of the improper execution of its various building phases, began showing signs of instability precipitated by violent events. In 1999, the R.B.C. roof of the front hall collapsed for reasons still unknown, and was later built anew in reinforced cement concrete (R.C.C.). The two columns in the main hall were never replaced.

In 2005 the Museum' structure was undermined by the earthquake that hit the entire north Pakistan, causing serious damages to every connection of the structure, (i.e. foundations/walls; walls/beams and beams/roofs) and causing separations between cladding stones and brick walls.

In February 2008 the structure of the Museum was seriously damaged by an explosion, on the road in front of the Museum that caused lesions in the load bearing brick masonry walls, in the beams and in the roof/ceilings.

Before its renovation project and its closure, the Swat Archaeological Museum attracted researchers and tourists from Pakistan and indeed the entire world because of its unique Gandharan collection. At the time the collection was formed by more than four thousand objects, out of which there were 2,855 Gandharan sculptures and architectonic fragments. The removal of the artifacts was entirely organized by DOAM (Federal); the objects were initially relocated in the Taxila Muse-



## 1. Architecture of the 50s in Saidu Sharif and Swat Archaeological Museum

um and finally to Peshawar Museum under the responsibility of DOAM (KP).

In March 2011, ACT took on the rehabilitation and reconstruction of the Swat Archaeological Museum, in order to upgrade the structure seismic resistance to a level consistent to the area's high seismicity, and to design a new master plan and new artifact displays. A professional team was formed to this effect, under the coordination of ACT's architects Ivano Marati and Candida M. Vassallo, and consisted of:

- Consultancy Cell from University of Engineering and Technology (UET), Peshawar, Pakistan, to perform the structural health assessment of the extant building and to determine the necessary guidelines for the demolition and the rehabilitation of the remaining structure, as well as for the vetting of the structural drawings of the new part;
- Claudio Cristilli, engineer, professor (retd.) of the Dipartimento di Tecnica delle Costruzioni, Università "Federico II", Naples, Italy and AIREG Ingegneria, Technical Studio Associates, Caserta, Italy to design the structural design of the new part of the building;
- ACT's co-directors: (ISI/IO): Luca M. Olivieri; (DOAM Federal): Fazal Dad Kakar (until April 2011); (DOAM Provincial): Saleh Muhammad (late; until July 2011), Nidaullah Serai (until January 2012), Shah Nazar Khan (until April 2013), Nidaullah Serai (current);
- DOAM Focal person: Mr Faiz-ur-Rahman, Curator Swat Museum.

## NOTES

1. In this period, Le Corbusier was working for the urban plan of Chandigarh, the new capital of the Indian Punjab.
2. Just a few examples: in 1966 the Pakistan Government Buildings (Presidential Palace, Supreme Court Building, National Assembly, Foreign Office and Central Square) and in 1967 the University of Islamabad (Quaid-i-Azam University) by American Architect Edward Durrell Stone; in 1969 the Turkish architect Vedat Dalokay won the international competition for the Faisal Mosque; in 1962 the Pakistan House Hotel; in 1962-64 the Palaces for Ministries by Italian Architect Giò Ponti.
3. In February 1959, H.E. The President of Pakistan nominated the Greek Architect and Urban Planner Constantinos A. Doxiadis as advisor to the Special Commission for the Location of the Capital. The site was located to the north of Rawalpindi at the foot of mount Margalla. To Doxiadis was assigned the Master plan (see the website [www.doxiadis.org](http://www.doxiadis.org)).
4. See the historical overview in <http://news.ukpha.org>.
5. The Yusufzai State of Swat, whose capital was Saidu Sharif, was founded in 1917, when the *Jirga* proclaimed Miangul Gulshahzada Abdul Wadud as Badshah of the Swat. In 1926 British authorities recognized formally the title of Badshah and the State of Swat (Olivieri 2009: 80).
6. Around 1923, the Swat territory was subdivided between aristocratic families (the feudal *Khan* system) that held control over specific areas, the tradition of land rotation notwithstanding. The *Khans* and the upper classes congregated in the *jirga* where all important decisions were made. (Olivieri, 2009: 81). "The Swat State entered upon an era of progress after 1926. Within the space of a decade the State has made such a wonderful progress as has amazed the neighboring tribes and the contemporary Frontier States." (Mohd, Qasmi 1949: 38)."
7. In 1926, during the reign of Badshah Saheb, the first exploration was conducted by Sir Aurel Stein, who found and identified important archaeological sites, following the steps of the Chinese pilgrims in the Swat valley. (Callieri 2011: 5).
8. In 1949, at end of Badshah' Rule, there were one high school, three middle schools, nine lower middle, and twelve primary schools in the state, spread over an area of about four thousand square miles. In 1922 the first primary school was opened in Saidu Sharif and in 1926 a separate Girls' School was opened also in Saidu Sharif (Rome 2008: 217, 219).
9. During the rule of Mianguls illiteracy decreased down to 20% in 40 years. Free education was guaranteed by grants for poor students, competitive salaries for teachers and the construction of schools (Barth 1985: 113).
10. During his reign the Wali built the Jahanzeb Degree College in Saidu Sharif, 37 High Schools, 33 Middle Schools, fourteen lower Middle Schools, 164 Primary Schools and 120 lower Primary Schools (Rome 2008: 217).
11. At the end of 1947, 563 kilometers of metalled roads and a great number of bridges were built in order to connect the State of Swat with the rest of the country by the main roads of Mingora-Malakand and Buner-Mardan.
12. According to the time's infrastructure rules, there were state-wide assigned areas where new constructions were forbidden. Furthermore, garages were allowed at a distance of 10 ft from the road, while building a garage at a street corner was forbidden under pain of demolition.
13. In 1939, Budshah Saheb aware of the need to preserve and store adequately the archaeological artifacts, thought to assign a room of his Palace as Museum, in order to exhibit the most significant artifacts uncovered up to that time (Barger and Wright 1941:13).
14. The team that organized the display of the Museum was composed by its first curator Inayat-ur-Rahman and by the IAM experts Domenico Faccenna, Massimo Taddei and Giorgio Stacul (Khan 1997: 17).
15. The Dar al-'ulum was realized in 1943 following the suggestion of Badshah Saheb (Rome 2008: 228).
16. Personal communication, DOAM KPK, Peshawar. Apparently, no official documents exist on the year the new façade was built.
17. Stone diaper masonry (between mid-2nd and mid-3rd century CE), is a style of masonry on which spaces between large blocks are filled with stone flakes (Singh 2008: 389).
18. From ancient Egypt on, the barrel vault has been an architectural element formed by the extrusion of a single curve along a given distance, used to cover spaces. It unloads on both sides along springer blocks and it should be supported by walls or by arches along the lateral springer blocks.

## 2. The Swat Museum in 2011

*Mohammad Ashraf (Project Director and Structural Designer, UET)*





A first assessment of the Swat Museum was made by I. Marati, in order to evaluate the structural condition of the building. The assessment revealed diffuse damages as a consequence of the earthquake of 2005 and of the blasting which occurred in 2008. It was necessary to carry out an in-depth structural analysis of the building, in all its structural parts, in order to determine if the building had to be demolished, or if it could be rehabilitated.

To this end the UET was asked to provide a structural assessment of the Museum's structure, as well as the condition of the foundation, the lateral load resisting elements and roof slabs, and to evaluate the general strength of the building.

After a first meeting, on March 25th 2011, held in order to clarify the scope of work and to collect the basic information necessary for the tests on the structural elements, UET appointed a team on site to implement the appropriate tests and to collect information<sup>1</sup>. The latter were successively elaborated in its laboratory at Peshawar University as it is described in detail in this paper.

In this page all the photographs are by DOAM, Government of Pakistan





1. View of Museum (2007)

## 2.1 Structural Health Assessment (SHA)\*

Before developing the Master Plan for the Swat Archaeological Museum, ACT decided to perform a thorough Structural Health Assessment (SHA) of the existing building, in order to evaluate scientifically the possibility of any demolition and/or retrofitting. The officials of ACT contacted Consultancy Cell at UET and requested that the said assessment be carried out. Consultancy Cell having the expertise, experience and all necessary equipment, agreed to carry out the assignment. The project was assigned to prof. dr. Mohammad Ashraf and prof. dr. Amjad Naseer.

The team made a preliminary site visit on April 1st 2011, and prepared a comprehensive SHA plan including various field and laboratory tests.

The SHA was carried out according to the following steps:

- Development of as-built drawings for the existing Museum building including plans, elevations and sectional views;
- Identification and location of cracks and other deficiencies in the building;
- Performing various field and laboratory tests in order to determine material properties (compressive strength of concrete, shear strength of brick masonry), bearing capacity of foundation soils, detail of reinforcement, etc;
- Numerical and analytical capacity evaluation of existing building.

\*In this section, all the photographs and drawings are by UET

2. Roof at different heights



3. Vertical separations of the orthogonal walls



4. Cracks in the stone masonry facade



5. Crack in the plinth protection



The following members from Consultancy Cell, at UET Peshawar, were involved in the project:

Prof. Dr. Akhtar Naeem: Team Leader/Expert

Prof. Dr. Qaisar Ali: Technical Expert

Dr. Mohammad Ashraf: Project Director and Structural Designer

Dr. Amjad Naseer: Field Investigation Expert

Engr. Zareef Khan: Construction Supervision Engineer

Engr. Shams Ul Khaliq: Assessment Field Engineer

Engr. Nadeem Ul Khaliq: Assessment Field Engineer

Mr. Fazal-e-Rabi: Non-Destructive Test Technician

Mr. Shah Hussain: Draftsman

Mr. Sami Ullah: Core Cutting Technician

Mr. Gohar: Soil Laboratory Technician

Mr. Fazle Khuda : Field Helper

Mr. Swab Ali Shah : Care Taker and Driver

### 2.1.1 Building Description

The old Museum building was primarily an un-reinforced brick masonry structure with rigid diaphragm made partially with R.B.C., and partially with R.C. slab and beams. External walls were provided with random rubble stone masonry façade (fig. 1). The Museum building consisted of six side galleries (about 19 ft x 39 ft), one reception hall (about 45 ft x 32 ft) at the front, one gallery hall (about 44 ft x 32 ft) at the back and one central gallery (about 45 ft x 19 ft). Those galleries were connected to each other through 8 ft x 8 ft openings. At the front of the building, there was a verandah with an arched roof. The roof slabs of the galleries were located at different heights (fig. 2).

### 2.1.2 Observed Damages

As a consequence of the bomb blast of 2008, the walls of Museum building were severely shaken and damaged. Cracks were later re-



6. Shear test in progress



7. Core cutting in progress from roof slab

paired by plaster and were not visible during the site visit. The following damages were observed in the buildings:

- Vertical separation at the T-connection between front-left gallery and central-left gallery (fig. 3);
- Seepage problems in the roof slabs;
- Diagonal crack in the wall between front-left gallery and central gallery;
- Various cracks along the stone masonry façade (fig. 4)
- Cracks in brick tiles on the roof;
- The existing plinth protection was cracked and separated from the building (fig. 5).
- The moisture content was too high in the foundation soil on the north side of the building (lawn side).



8. Ultra-sonic Pulse Velocity test in progress

### 2.1.3 Field and Laboratory Tests

Various field and laboratory tests were performed in order to determine the material properties required for the SHA. In-situ shear strength of brick masonry walls was evaluated using push tests (fig. 6). Compressive strength of concrete was evaluated by testing concrete cores extracted from various structural elements, Schmidt hammer test and Ultrasonic Pulse Velocity test. Spacing of reinforcing bars in reinforced concrete elements was determined using rebar scanner. The various field and laboratory tests performed are given in figs 6-8.

The bearing capacity of foundation soil was evaluated by testing undisturbed samples collected from sites adjacent to existing foundation (fig. 9).



9. Excavation pit for collecting undisturbed soil sample

### 2.1.4 Numerical and Analytical Capacity Evaluation

The material properties, including the compressive strength of concrete and shear strength of brick masonry, as determined during site and laboratory tests, were used in evaluating the numerical and analytical capacity of the existing museum building. Other material properties, e.g. compressive strength and modulus of elasticity of brick masonry, were taken from indigenous research conducted at UET's laboratories.

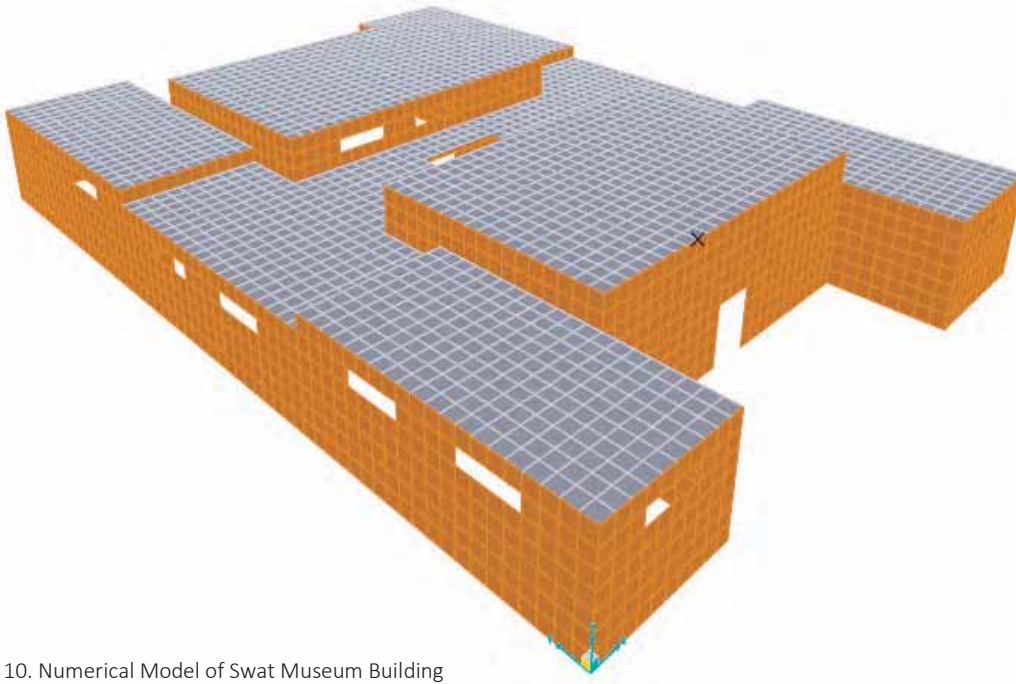
The numerical analysis was made through finite element based three-dimensional software, SAP2000 (fig. 10). The results, from the numerical models, are shown in figs 11-13.

The lateral drift ratio of the building was lower than the code minimum requirements. The compressive stresses in the load bearing walls were also less than the compressive strength of the masonry (based on research). However, the shear stresses, from the numerical model, were slightly exceeding the shear strength as determined from the field test at a few locations.

The lateral load carrying capacity of individual walls, in both the orthogonal directions, was also evaluated by carrying out empirical analysis of the building in accordance with Eurocode 8 and Building Code of Pakistan 2007 (BCP07). The building partially satisfied the empirical design criteria of the Building Code of Pakistan. The following shortcomings were identified:

- In the shorter direction, the wall density ratio was less than the permissible limit;
- Building height exceeded the provisions of the code;
- The aspect ratio of the walls also exceeded the maximum required by the code;
- The foundation was not adequate.



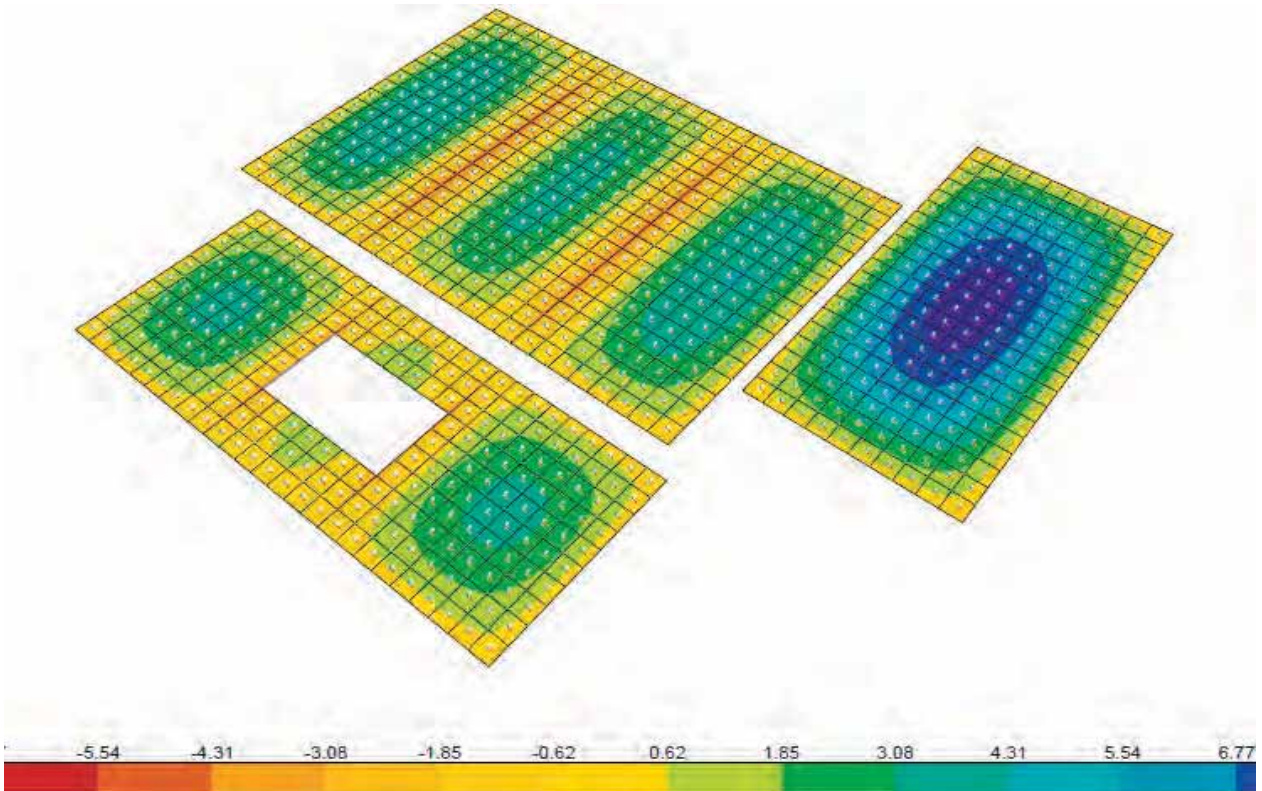


10. Numerical Model of Swat Museum Building

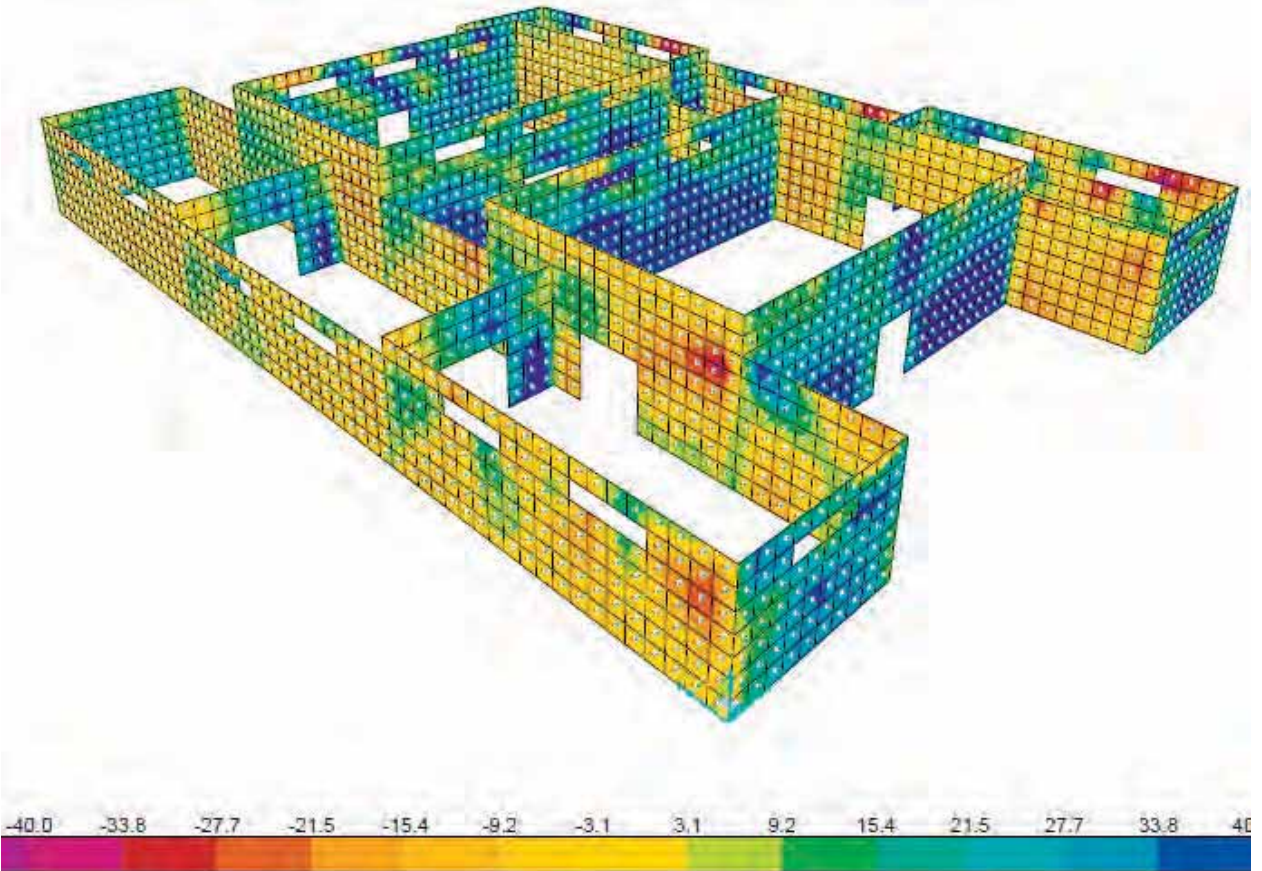
It was therefore recommended to increase the wall stiffness in general and in the shorter direction in particular. As the gallery 1 and 4 did not satisfy aspect ratio criteria, as well as height and unsupported length criteria, it was recommended to demolish these galleries. The remaining part of the Museum building was recommended for retrofitting.

### 2.1.5 Conclusions from SHA

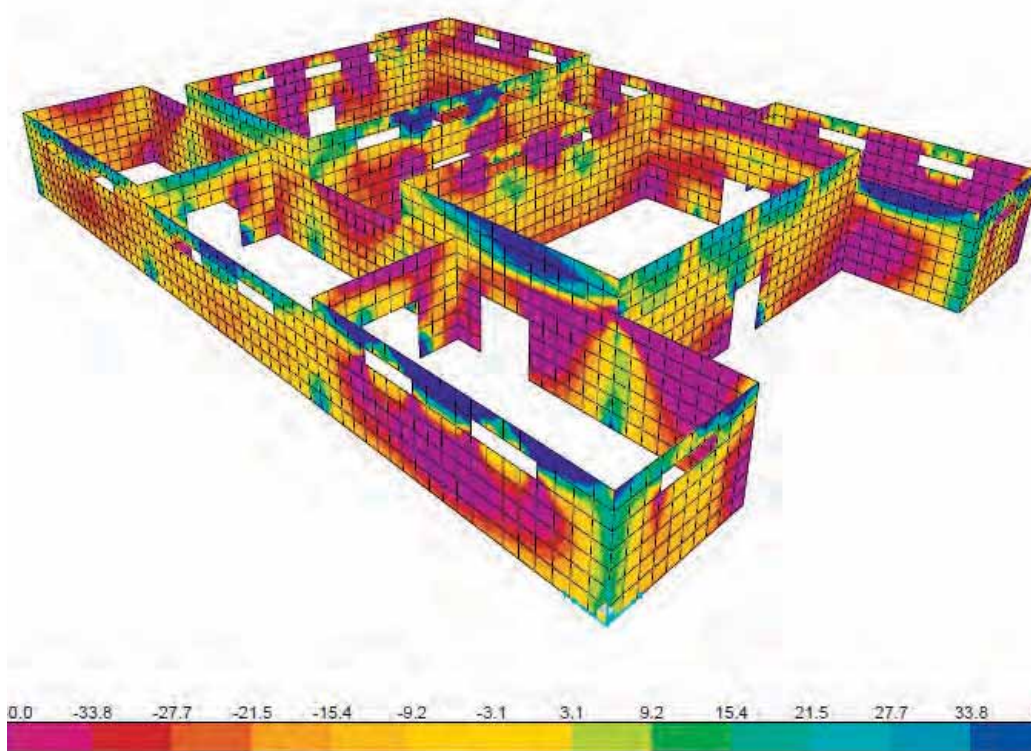
- The old building was slightly damaged with cracks in a few locations. Seepage problems were also noticed.
- The quality of concrete as a whole was very good. The average compressive strength of concrete were: 3500 psi for the gallery hall at the back; 4324 psi for two front galleries and 4868 psi for the other galleries.
- The capacities of beams and slab qualified marginally the corresponding existing demands. It was, therefore, recommended that any additional load should not be added to the roof slab of the building.
- The compressive stress demand on the masonry walls was less than the capacity. Furthermore, the drift ratio of the building, based on the numerical analysis, was less than the code requirements. However, the code requirements regarding the minimum wall density ratio in the shorter direction and maxi-



11. Moment demand (1.2DL + 1.6LL) on slab in short direction (kip-ft)



12. Vertical Stress Distribution for DL+LL+EQx- unit psi



13. Shear Stress Distribution for DL+LL+EQx– unit psi

imum unsupported length limitations, were not satisfied. The shear stress in masonry walls also exceeded the shear strength of masonry.

- The bearing capacities, based on the soil samples taken near the foundation, were 0.53 and 0.8 ton per sqft . However, bearing capacity, based on unconfined test from the test pit 3, was too low because of high moisture content.
- The existing foundation was verified at test pits 1 and 2. The existing width of the wall footing at test pit 1 was insufficient for the distribution of the superstructure load. However, no foundation settlement has been observed in the Museum building.
- The height, aspect ratio and unsupported length of outer walls in the two front galleries (gallery 1 and 4) did not satisfy the minimum code requirements. The foundations of these walls were also found to be insufficient to support the existing load. Furthermore, the roof slabs of these galleries are made in R.B.C. of insufficient thickness.

### 2.1.6 Recommendations from SHA

Based on the SHA it was recommended:

- To avoid any additional load on existing floors/roofs of the building, since the reinforcements of the slabs, of the hall and





14. Application of ferrocement overlay



15. Shake table test of one room model retrofitted with ferrocement



16. Quasi static test of full scale room retrofitted with ferrocement

galleries, as well as in the beam of the hall, were barely sufficient to support the existing loads.

- To avoid using any vibrating machinery or any other equipment creating vibration.
- To prevent water penetration to the foundation soil by providing proper plinth protection, cut-off walls and water drains.
- To demolish two galleries, at the front of Museum building, and to retrofit the remaining part.

## 2.2 Retrofitting of existing building

A retrofitting scheme was designed by UET for the existing building of the Swat Archaeological Museum using state-of-the-art techniques of ferrocement overlay and cement-based grout injection, in addition to the confinement of openings and concrete stitching. These techniques are not only efficient and effective in reducing the seismic risk but also very economical.

Ferro-cement overlay is a well established technique used worldwide in the retrofitting of masonry and concrete structures. In this technique, a steel wire mesh is fixed with masonry walls and then plastered with a rich mix of cement-sand mortar (fig. 14). The technique has been thoroughly investigated for local masonry at the Earthquake Engineering Center, Department of Civil Engineering in UET as part of the PhD research of this writer (Ashraf 2010). A number of quasi-static and shake table tests (fig. 15, 16) have been conducted on masonry models retrofitted with ferro-cement overlay. The technique was found very effective in enhancing the seismic capacity of unreinforced masonry buildings (Ashraf et al. 2009, 2010, 2011, 2012). Application and design guidelines were also developed as a part of this study.





17. Grout injection in masonry wall



18. Application of ferrocement overlay, Commerce College Mansehra



19. Cement based grout injection, Commerce College Mansehra



20. Concrete stitching, Commerce College Mansehra

Grout injection is a technique used to restore the pre-damaged state of concrete or masonry buildings. In this technique cement or epoxy based grout is injected through cracks with the result of developing a bond between cracked surfaces (fig. 17). A number of cement-based grouts were investigated at the Department of Civil Engineering, UET for the repair of cracks in local masonry buildings. Finally a grout mix was developed consisting of Portland cement, lime and expansion agent.

These techniques have effectively been applied to many damaged buildings, not only in earthquake affected areas of Pakistan (affected in the 2005 Kashmir earthquake) but also in Iran (affected in the 2003 Bam earthquake). Some of these projects are mentioned as follows.

The unreinforced masonry buildings (two stories) of the Government Commerce College in Mansehra were moderately damaged during the 2005 Earthquake. These techniques were applied to the damaged buildings, not only to restore their pre-damaged capacities but also to sufficiently improve the anti-seismic capacities and to meet the seismic requirement of the area as per building code of Pakistan (fig. 18, 19, 20). The retrofitting scheme was approved by the Earthquake Reconstruction & Rehabilitation Authority (ERRA)<sup>2</sup> and its execution is in progress (near completion).

The techniques were also used in the design of retrofitting scheme for the Supreme Court and High Court buildings of Muzaffarabad.



21. AJK Supreme Court, Muzaffarabad



22. School building in Bam

The Supreme Court building (fig. 21) is an unreinforced masonry building whereas the High Court building is a R.C. frame structure with infill masonry. Design of the retrofitting scheme has been approved by ERRA and the site execution will start soon.

A retrofitting scheme, using these techniques, was designed for school buildings (fig. 22) in earthquake affected areas of Kerman District of Iran, by Department of Civil Engineering, UET, for Sar Nevesht Saz (SNS), a Japanese non-profit organization (INGO).

A strengthening and retrofitting scheme, on the basis of the structural health assessment, was developed for the existing building of Swat Archeological Museum. The detail is as follows:

- Application of ferrocement overlay on all masonry walls (fig. 23).
- Injection of cement based grout through cracks in masonry walls (fig. 24).
- Stabilization of stone masonry façade by injecting the grout and by introducing R.C. keys between stone and brick masonry (fig. 25)
- Confining existing openings in walls with reinforced concrete elements (fig. 27)
- Providing proper plinth protection and cut-off walls (fig. 26).
- Prevention of water penetration through the clay tiles on the roof.

During the execution works, some changes were made in the original design, e.g. R.C. keys designed for stabilization of stone masonry façade were replaced with mechanical keys, a slight change in design of plinth protection, etc.

## Description of the Construction Process

**Grout Injection:** cement based grout (10 parts of cements, 1 part of lime (by weight) and Expansion Agent @ 250g per 50 Kg of cement mixed with a water-cement ratio of 0.9) injected through cracks in masonry walls. Steps followed:

- The existing plaster was scraped off from the cracked portion of masonry walls.
- All loose mortar from masonry joints was removed and replaced with a rich mortar in 1:3 Cement-Sand Mortar (C.S.M.).
- The masonry was thoroughly wetted before replacing the mortar.
- Holes (1/2" dia) were drilled along the cracks at a distance of about 12" on center. The depth of holes was equal to half the thickness of masonry wall.
- Before fixing injection's ports/nozzles a welded wire mesh has then been applied on masonry walls.
- Injection port (3/8" dia) has then been fixed with a rich mortar.
- When the plaster and mortar used in fixing injection ports reached enough strength (after about 14 days), water was passed through the nozzles starting from the top nozzle and moving downward in order to moisten the masonry and to check the connectivity of nozzles.
- As a final step, the grout has been passed through the nozzles starting from bottom nozzles and moving up on masonry wall. Initially the injection pressure was kept at about 30 psi. The pressure has then been increased gradually from 30 to 60 psi to densify the grout and to expel the excess water in the grout. Grout coming out of nearby ports was blocked using stoppers.

The stone **masonry façade** was stabilized by the above mentioned grout injection and providing R.C. keys as detailed in the drawings. The procedure was executed through the following steps:

- Cement based grout was passed through injection ports as detailed in the previous section. It not only filled cracks in stone masonry but also the internal voids between brick masonry walls and stone masonry façade.
- R.C. keys were provided along the surface of the façade, connecting wall and façade as detailed in the drawings. The hole in brick masonry walls was drilled through 6" dia core cutter. A complete stone was removed from the stone façade.



23. Wire mesh application and fixing injection nozzles



24. Stabilization of stone masonry façade by grout injection



25. Wall stitching and RC column connection. Wire mesh is also visible





26. Plinth Protection and drains in old block



27



27-28. Reconstruction of corner wall



29. Steel reinforcement structure in the opening

**Concrete Confining Element:** Vertical confining element in R.C.C. 1:2:4 (1 part of cements, 2 part of sand, 4 part coarse) were placed in the openings as follows:

- The existing plaster was scraped off from the beam in order to put in light steel reinforcement bar;
- According to technical drawings, reinforcement steel was fixed starting 1 ft under the existent flooring;
- Pillar Steel bars have been connected to the beam steel bars;
- Concrete in Formwork to complete the works.

Ferro-cement overlay made with welded wire mesh and plaster as given in the drawings was applied on the internal sides of all masonry walls. The step-wise procedure is as follows:

- The existing plaster was scraped off from the internal sides of masonry walls.
- Holes were drilled in bricks (not in mortar joints) at the specified distances as detailed in the drawings.
- The welded wire mesh was then connected to the surface of walls through screws as detailed in the drawings. Folds in the mesh (if any) was removed by applying additional screws.
- Before application of plaster the surface of walls was thorough wetted by sprinkling of water for about 24 hours.
- Plaster was then applied on the walls in two steps. In the first step the space between mesh and wall surface was filled with mortar. The finish coat was applied as the 2nd step.

In the cracked regions plaster was applied after fixing the injection nozzles along the cracks. In this way the plaster was used as sealant which prevented grout coming out of the cracked regions and the surrounding

#### NOTES

1. The meeting was attended by prof. dr. Qaisar Ali and dr. M. Ashraf from UET side and dr. L.M. Olivieri and I. Marati from ACT.
2. The Earthquake Reconstruction and Rehabilitation Authority (ERRA) was established to effectively respond to the October 2005 earthquake in Pakistan. Its key functions are to plan, approve, monitor and evaluate, coordinate, and facilitate all reconstruction and rehabilitation efforts. Thus far it has met its challenges successfully with the support of the Government of Pakistan, the Government of NWFP, the Government of AJK, donor agencies, national and international NGOs, and a range of other stakeholders. (International Recovery Platform)



### 3. The New Swat Archaeological Museum



For the last 50 years DOAM and IAM have conducted countless archaeological campaigns in the Swat Valley, collecting a great number of artifacts. For this reason an expansion of the existing Swat Archaeological Museum has become indispensable.

The Museum building, erected in 1959, has gone through numerous changes that had severely compromised the stability and efficiency of the structure. The addition of five galleries, the removal of two columns in the central hall, the closure of some doors and windows, were all implemented in order to maximize exhibit space, but in the process the problems inherent to structures, built with a variety of techniques as well as with a variety of heterogeneous materials disconnected from one another, were severely underestimated. The structural problems of the Museum, were furthermore exacerbated by the 2005 earthquake and the 2008 explosion.

In addition, bricking over several doors and windows caused a marked reduction in natural light in the galleries. Usually, in modern Museums, this fact is normally considered an advantage, since exhibited artifacts are better shown under track lights; however, in the case of the Swat Museum, using good natural light is fundamental because electricity is scarce and unreliable on a daily basis.

Before ACT's involvement, the building was unable to meet the new Museum's requirements. It was decided that radical changes were necessary both in its structure and in efficient utilizations of exhibit spaces and lights. ACT took charge of the rehabilitation and reconstruction of the New Swat Archaeological Museum, and entrusted architects I. Marati e C. Vassallo for its design and the coordination of its construction.

During the design process, all aspects outlined above were carefully considered and were shared and discussed in great length between DOAM, ACT co-directors and ACT architects at their first meeting in March 2011. During that same meeting all the participants formulated a list of objectives for the realization of the New Museum, as follows:

- To construct an anti-seismic building, considering the high-risk seismicity of Saidu Sharif;
- To build new spaces: galleries and a conference hall;
- To safeguard the building from intruders and install an emergency plan.

At the same time these possible limitations were outlined:

- The available budget did not allow a reconstruction ex-novo of the entire building, with an anti-seismic structure and with the desired monumental characteristics;
- Daily shortages of electricity;
- Difficulties in locating materials and workers qualified for the construction of sophisticated anti-seismic structures;
- Difficulties in technical monitoring, caused by the precarious security situation in the Swat area from the past three years.

After an accurate evaluation of the objectives and their limitations, and after having considered the SHA of the existing building, compiled by UET, it was decided to demolish the frontal part of the edifice and to rehabilitate the remaining part “block H”. This solution has allowed to save about 420 sqmt (4,484 sqft) of the building, adding the necessary anti-seismic upgrades, at a cost considerably lower of a total demolition and reconstruction ex-novo. With the financial resources thus saved, it became possible to add two new blocks, one in front and one in the back of the existing building, both featuring an advanced anti-seismic structure and monumental proportions, and properly integrated to the existing structure.

### 3.1 Design Choices

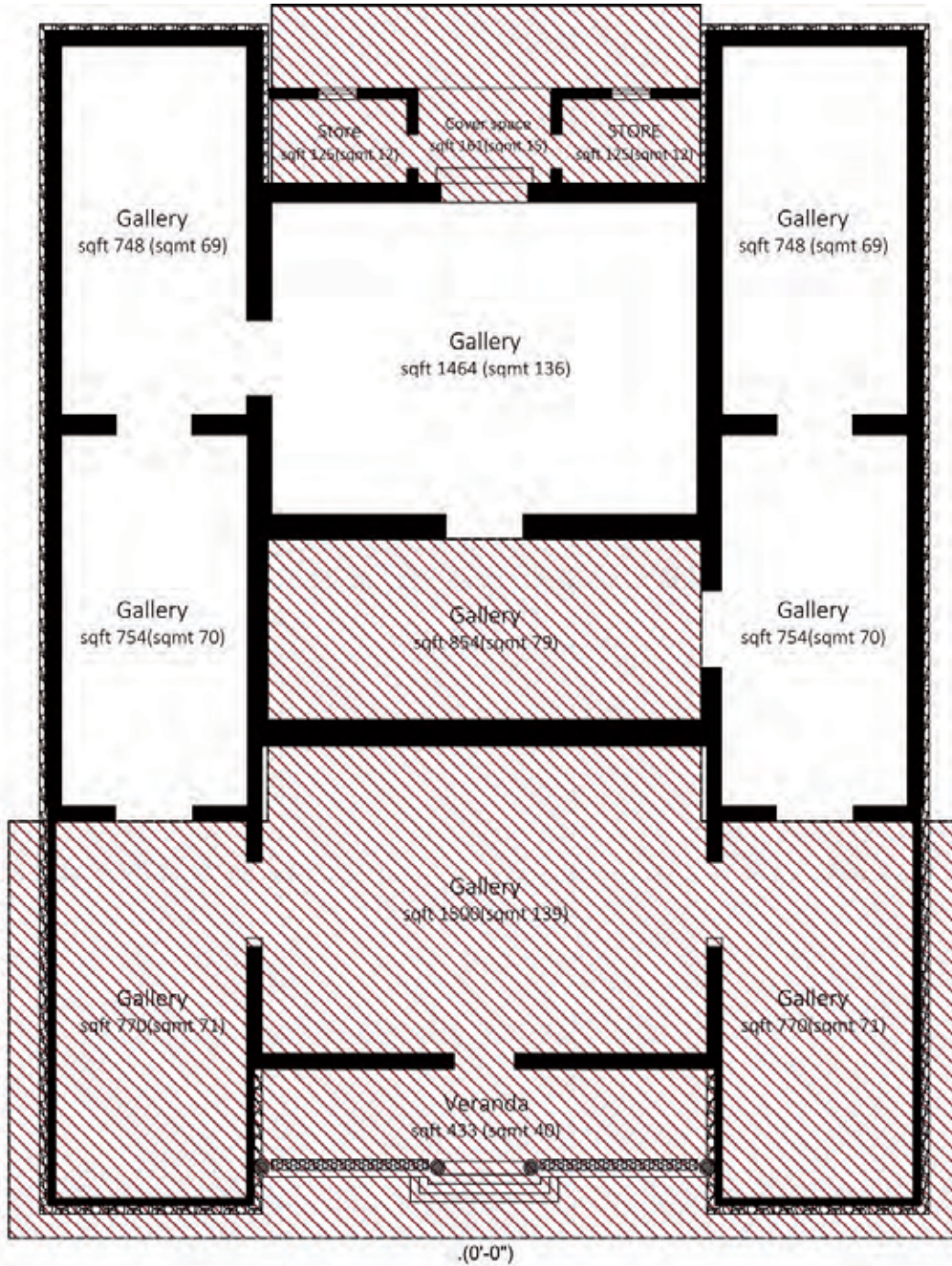
The design fundamental strategy was to erect a sustainable museum that would maintain its functionality in future years. By the same token, the problems inherent to the care and maintenance of the structure and to its security, as well as the lack of funds necessary to manage this considerably complex building, have necessarily influenced the design process and have compelled to choose an efficient and functional architecture, easy to manage, although diversified in the use of materials and techniques. Therefore the project was defined according to the most appropriate features both in its social and architectural context.

An ultra modern architecture of innovative materials and shapes would have been at odds with the surrounding cultural context and, without a doubt, would have necessitated an excessively expensive maintenance.

Furthermore it has to be underlined that the remaining part of the original Museum building, shaped now like a H (symmetrical in plan and elevation), and the limited available space in the compound among the other buildings, have strongly defined the design plans of the two new blocks. These requirements represent, on the one hand, a limitation to a freedom of design, but, on the other hand, they represent the fundamental theme of the composition, consisting of awareness and acceptance rather than a composition of form and articulated geometries. For this reason the project is unique and unrepeatable, and finds in its limitations the reason of its very existence.

The architectural composition springs from these strong constraints; it moves away from the surrounding building context and find its connections in the forms and volumes of the local fortified edifices, the strongholds and monasteries that abound in the area. The connection with these edifices is totally spontaneous and reaches a functionality dictated by a need to ward off both the chaotic





Existing building: Plan



LEGEND



TO BE DEMOLISHED



The *qala* of Manglawar (Swat State; Courtesy Miangul Family Archives)

encroachment of the city and possible attacks or intrusions, as well as the continuing need to function normally with minimal resources. All design decisions were dictated by real needs: building new spaces with a proper antiseismic structure; introducing two courtyards in order to provide the galleries with indirect light; building masonry showcases illuminated by low-energy lights that are easy to replace; posting steel grilles and bars against intruders instead of using electrically-operated security systems.

The building technology used, based on primary steel structures englobed in masonry, provides adequate ant seismic defenses dictated by Saidu-Sharif's high seismicity.

The use of steel structures in public buildings in Pakistan is fairly innovative. After mid-20th century, the reinforced cement structure has been the only technology used in new buildings while steel structures are the only ones used in infrastructures. This fact has created a widespread expertise with specialized labor as well as a large inventory easily obtained in largest cities like Islamabad, Lahore, Karachi and Peshawar. Therefore the scarcity of primary steel technologies is due to cultural reasons rather than to a lack of specialized workers. In order to render culturally acceptable the use of steel, local materials, such as stone and marble, were largely used in wall cladding and flooring, allowing the steel to be visible in only a few strategic points, showing the strong core of the Museum.

### 3.1.1 Architectural Composition

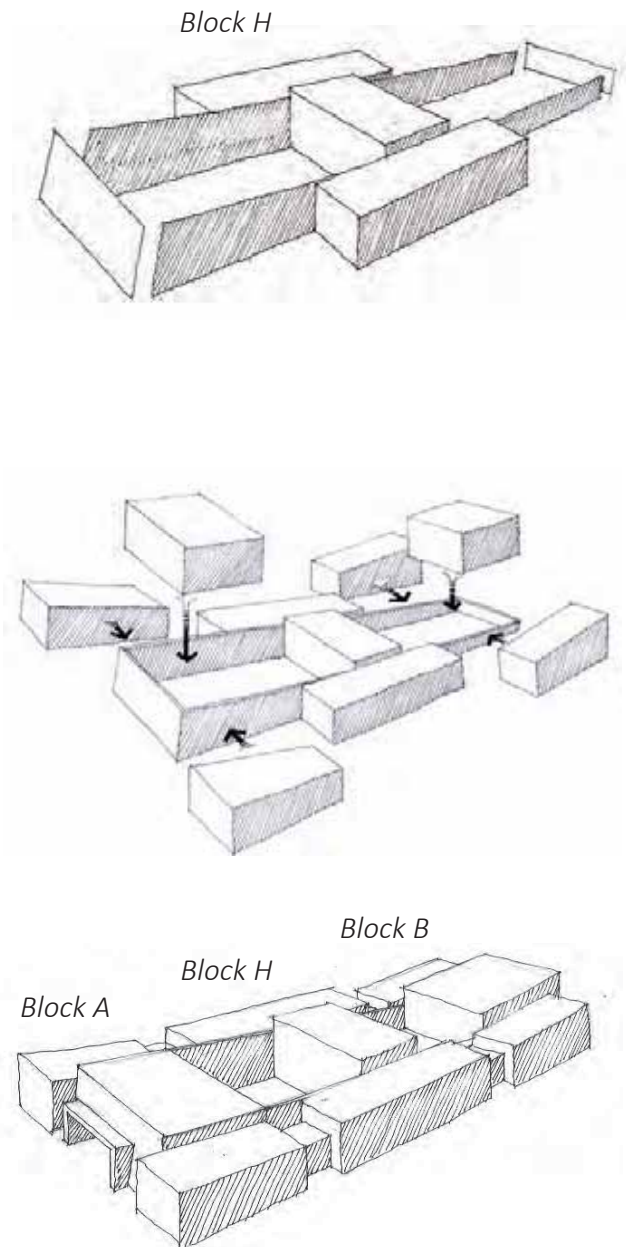
The architectural composition of the Museum emerges from the contraposition and integration of the volumes of the three blocks that define the edifice. At the center there is the “H” block that results from the selective demolition of the existing building; at the front there is the A block, and at the back the B block. The H block has defined the regular and symmetrical layout of the blocks A and B. The passage between the blocks takes place through the two courtyards and the four nodules of the emergency exits. An imposing slanted fence-Wall (henceforth defined as “Wall”), surrounds the three blocks in the central part, engulfing the courtyards. The Wall slowly emerges from the ground and connects the blocks, in a way similar to a memory that encompasses the past and the future, with a slender and transparent logic thread.

The Wall asserts its own strength on the central part of the façade in the A block, and recedes until it reveals the steel structure of the B block, crossing the courtyards. In the facade, the Wall retreats from the lateral galleries, invites the visitors to enter and guides them along all and every exhibit in the galleries, in this way becoming itself an exhibit in the courtyards. The entrance is marked by a parallelepiped that is inserted in the center of the façade’s Wall.

The blocks’ volumes, regular and symmetrical in plan, are defined by their different heights and slopes on the roof, and create their own rhythm of solid and empty spaces.

Natural light, entering indirectly from the courtyards, filtered by steel grilles or reflected by volumes’ surfaces, is an integral part of the architectonic composition. The natural light enters the galleries evenly, making electrical light almost superfluous.

Outside the edifice and in the courtyards, volumes and materials are exalted by the impressive geometries of the shadows that follow each other during the day, allowing the visitor to experience the spaces in a temporal dynamism.



These drawings are by F. Martore

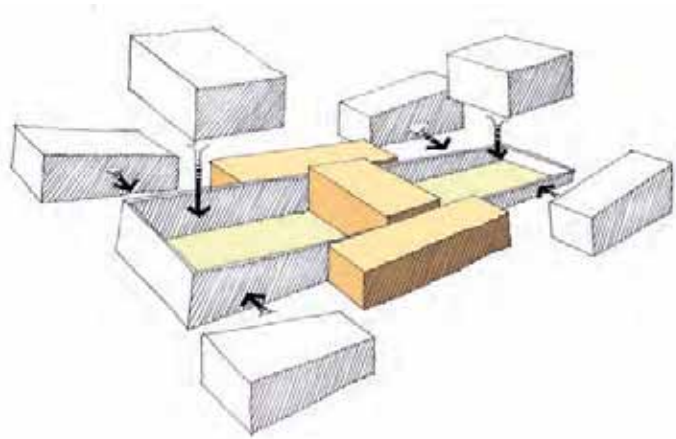


– **General Plan**

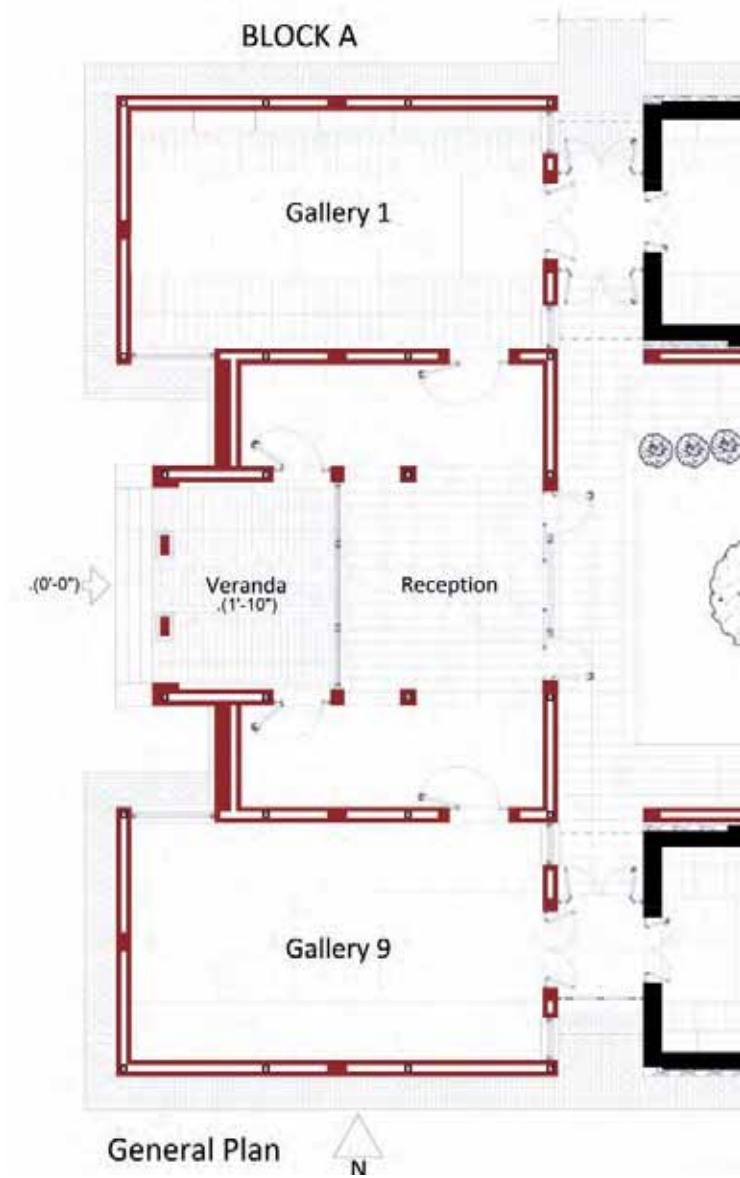
The Museum building, even if defined volumetrically, acquires a planimetric development that is regular and symmetrical, strongly dictated by the existing H block positioned between block A and block B. Planimetric continuity has been achieved by an alignment of new walls and existing walls, thus determining the width of the new galleries in blocks A and B. The plan, measured at quota (1'-10"), includes a reception hall, nine galleries, and a conference hall, all clustered around two exhibit courtyards positioned between the new blocks A and B and the existing block H.

The new Museum plan has an excess of about 135 sqmt (1452 sqft) of covered space in respect to the old edifice, and 321 sqmt (3450 sqft) of external space in the two courtyards where the exhibits continue.

Planimetric distribution, both of internal and external spaces, was designed as a way of guiding visitors by the hand, so to speak.

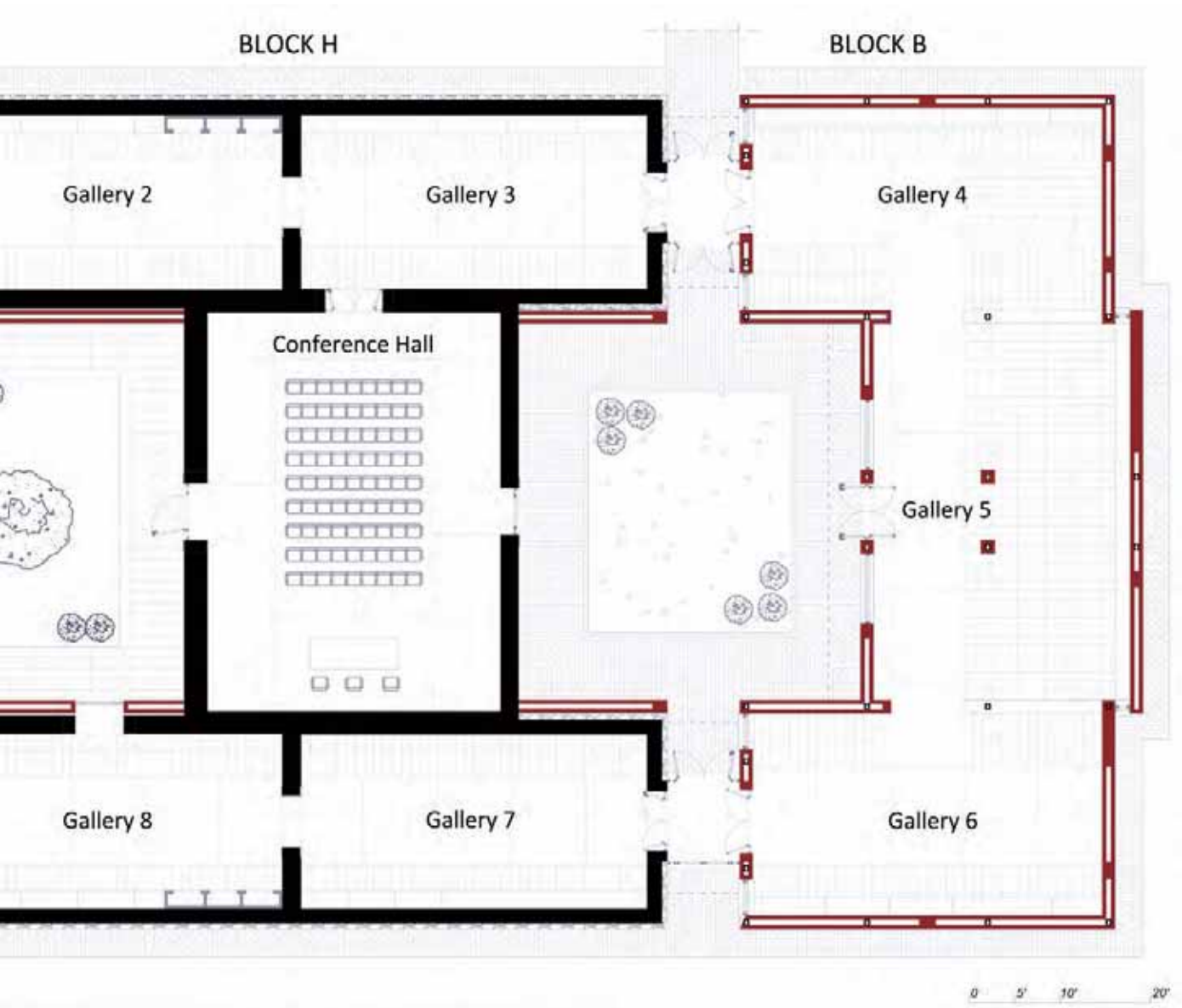


|                      | <b>Block A</b> | <b>Sqft</b>  | <b>Sqmt</b> |
|----------------------|----------------|--------------|-------------|
| Veranda              |                | 342          | 32          |
| Reception            |                | 841          | 78          |
| Gallery 1            |                | 868          | 81          |
| Gallery 9            |                | 868          | 81          |
| Emergency Exit space |                | 81           | 8           |
| Emergency Exit space |                | 81           | 8           |
|                      | <b>Block H</b> |              |             |
| Gallery 2            |                | 749          | 70          |
| Gallery 3            |                | 768          | 71          |
| Conference Hall      |                | 1437         | 134         |
| Gallery 7            |                | 768          | 71          |
| Gallery 8            |                | 762          | 71          |
|                      | <b>Block B</b> |              |             |
| Emergency Exit space |                | 81           | 8           |
| Emergency Exit space |                | 81           | 8           |
| Gallery 4            |                | 861          | 80          |
| Gallery 5            |                | 1209         | 112         |
| Gallery 6            |                | 861          | 80          |
| Courtyard            |                | 1718         | 160         |
| Courtyard            |                | 1732         | 161         |
| External passage     |                | 1886         | 175         |
| <b>Total Area</b>    |                | <b>15994</b> | <b>1486</b> |



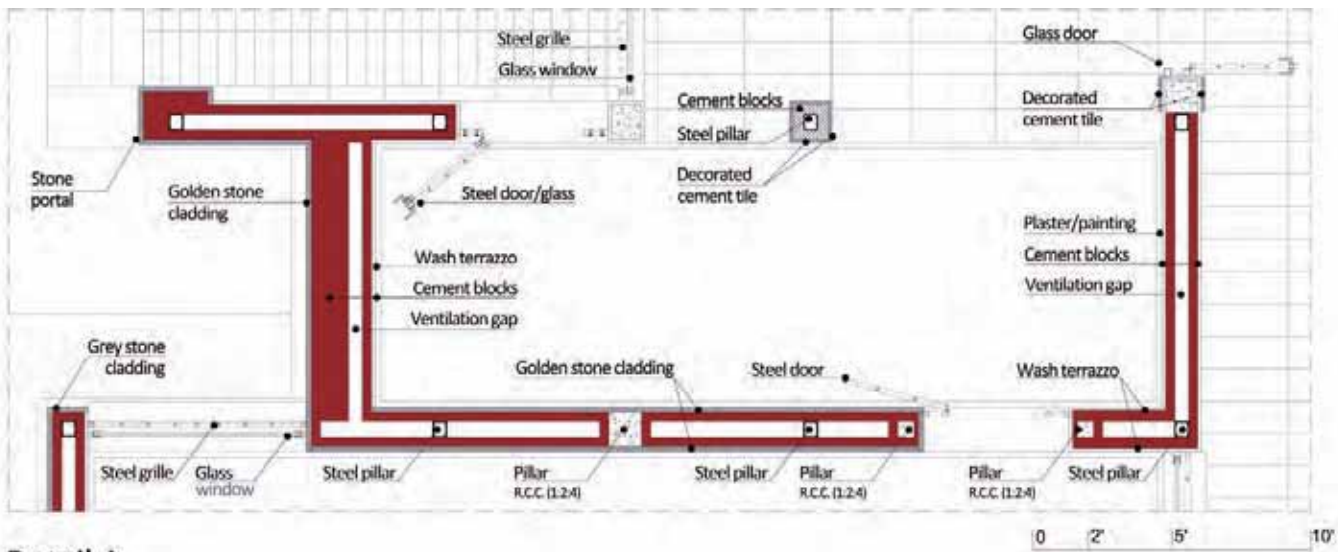
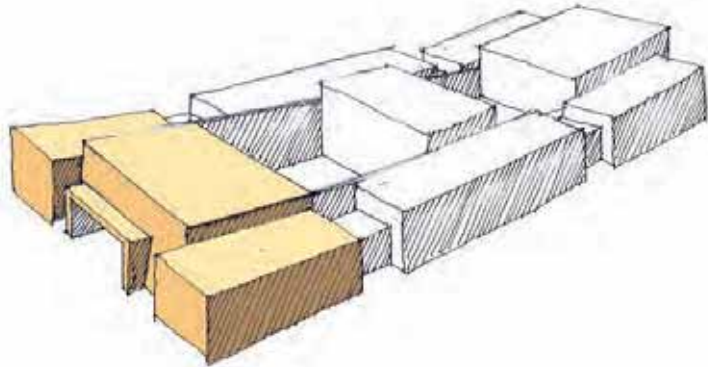


3. The New Swat Archaeological Museum

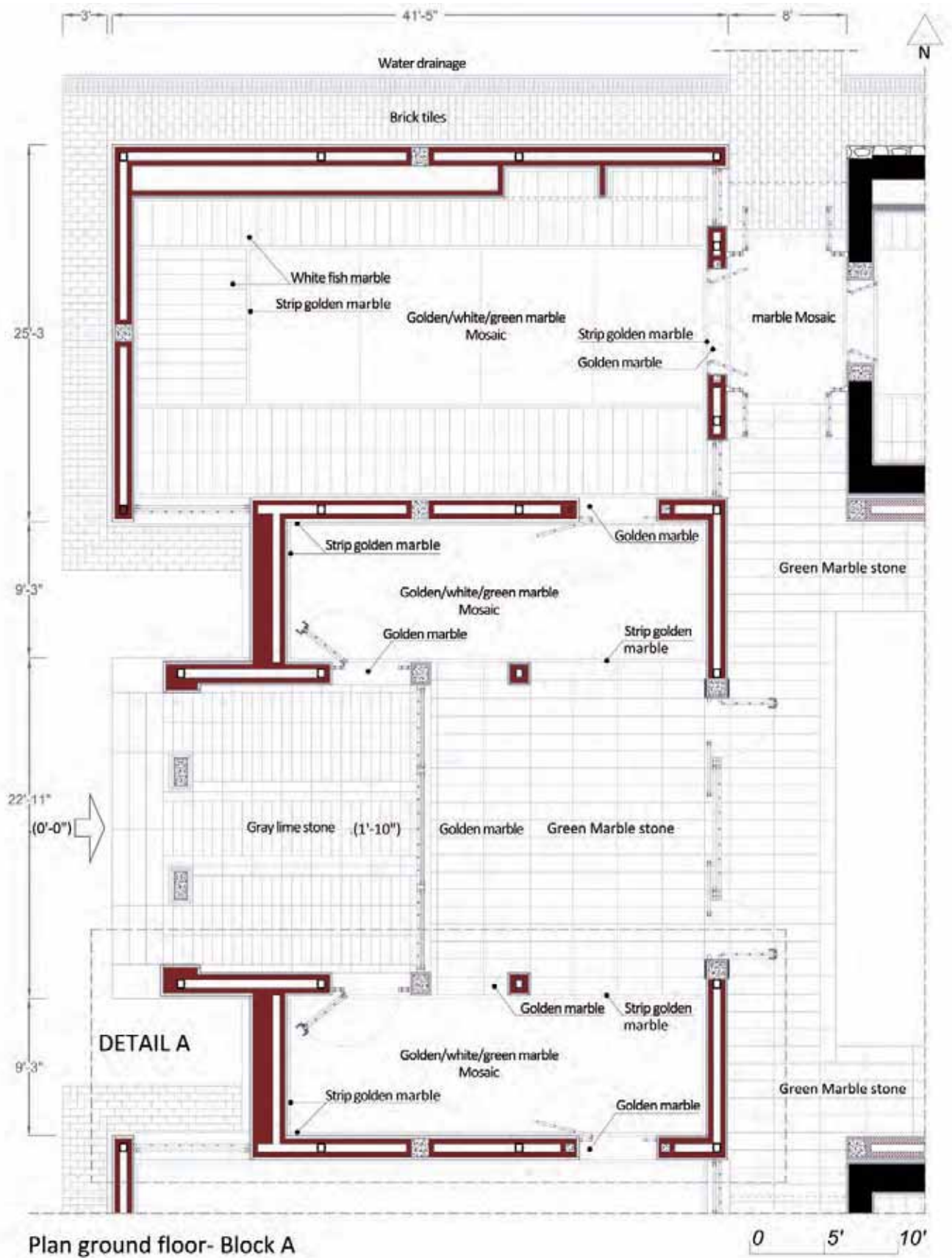


– Block A

The A block, on the front of the complex, consists of the entrance veranda, the reception hall and a rectangular gallery at each side, directly joined to the existing galleries. The entrance, by means of a covered external space, the Veranda, is defined by two columns at the front and a steel grille at the back, flanked by two doors that open into the reception hall. The doorways are located at the sides rather than the centre to inspire visitors to a respectful decorum. The exhibit's journey begins and ends in the reception hall, with doorways to the first and last galleries. From the reception hall, a large gridded glass wall opens directly to the first courtyard.



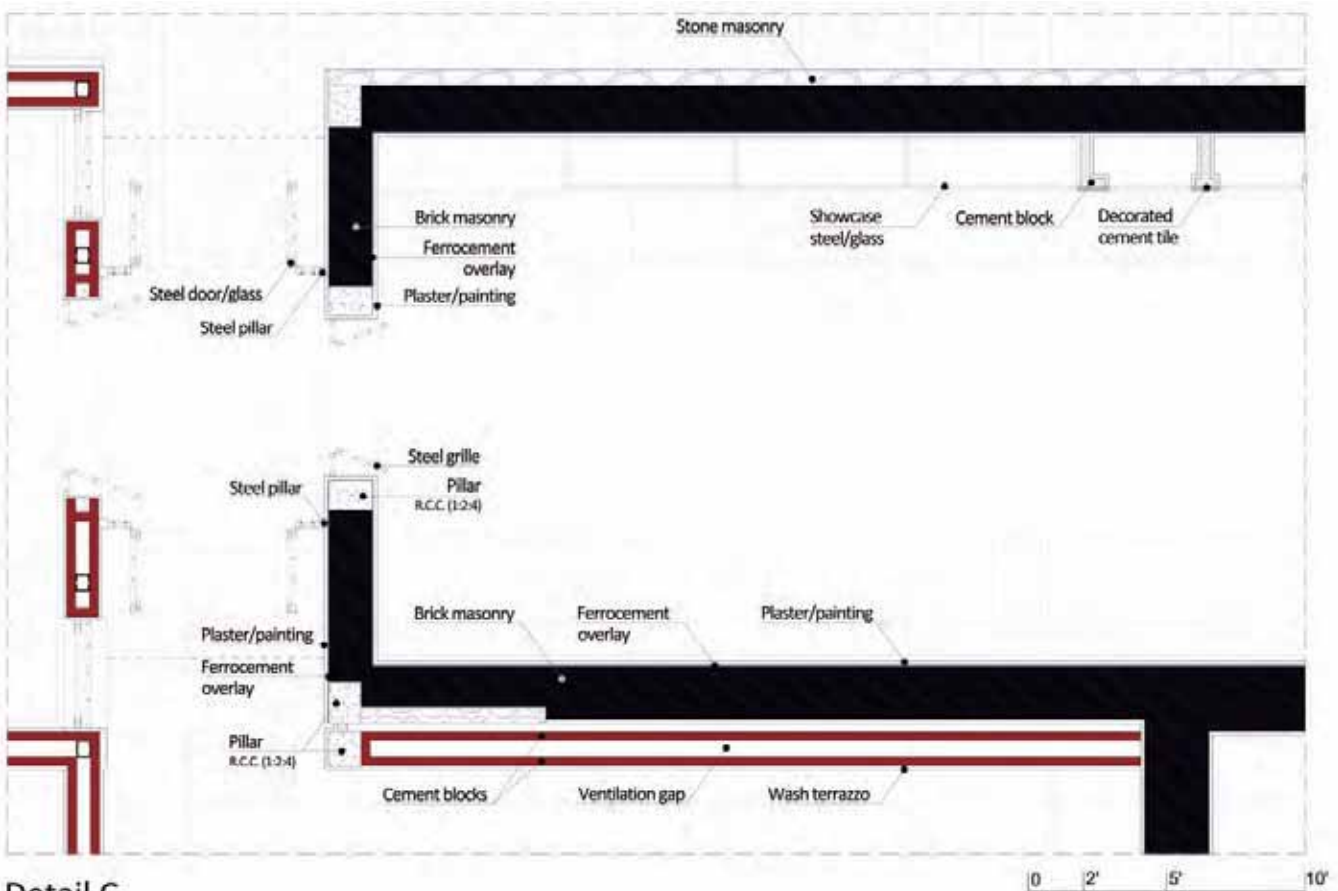
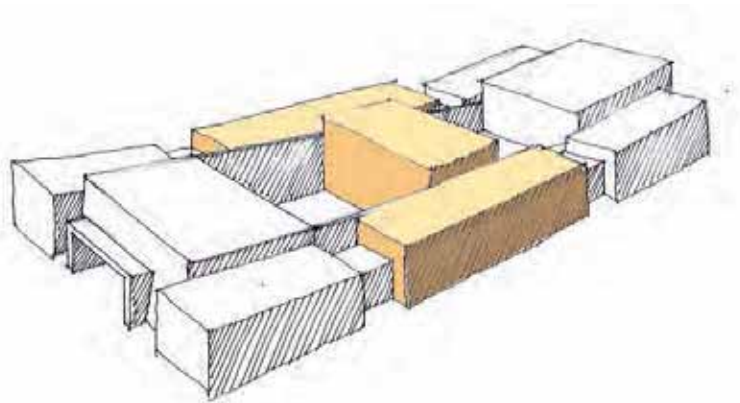
Detail A



Plan ground floor- Block A

– **Block H**

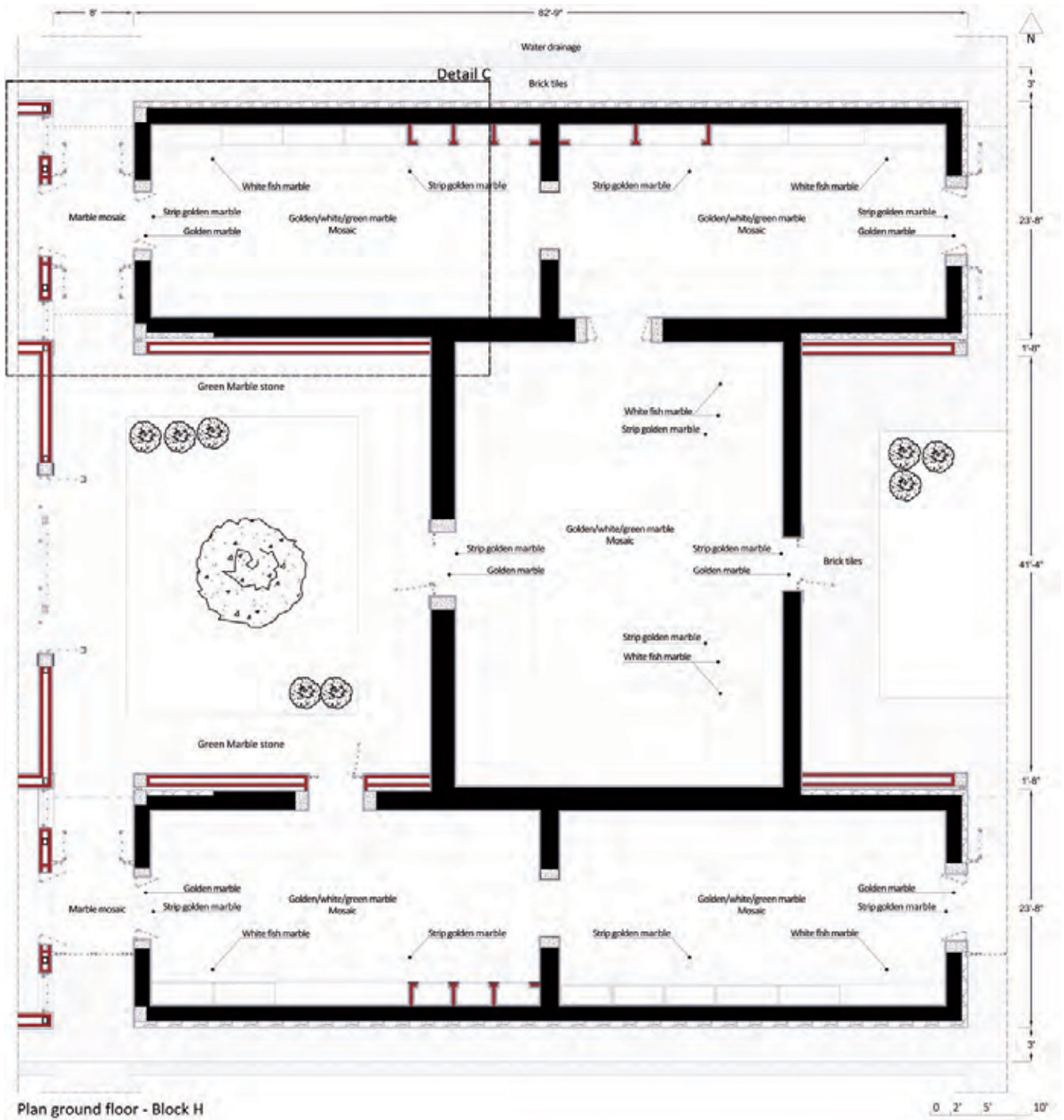
The H block consists of a central rectangular space, a conference hall, and two adjacent galleries connected, at each side, to the galleries of blocks A and B. The conference hall, placed in the center of block H, is connected to both courtyards and the exhibits by an entrance placed on its shortest side. The central position of the conference hall allows for its independent use, its access being possible through the first courtyard, even when the Museum is closed.



**Detail C**



### 3. The New Swat Archaeological Museum

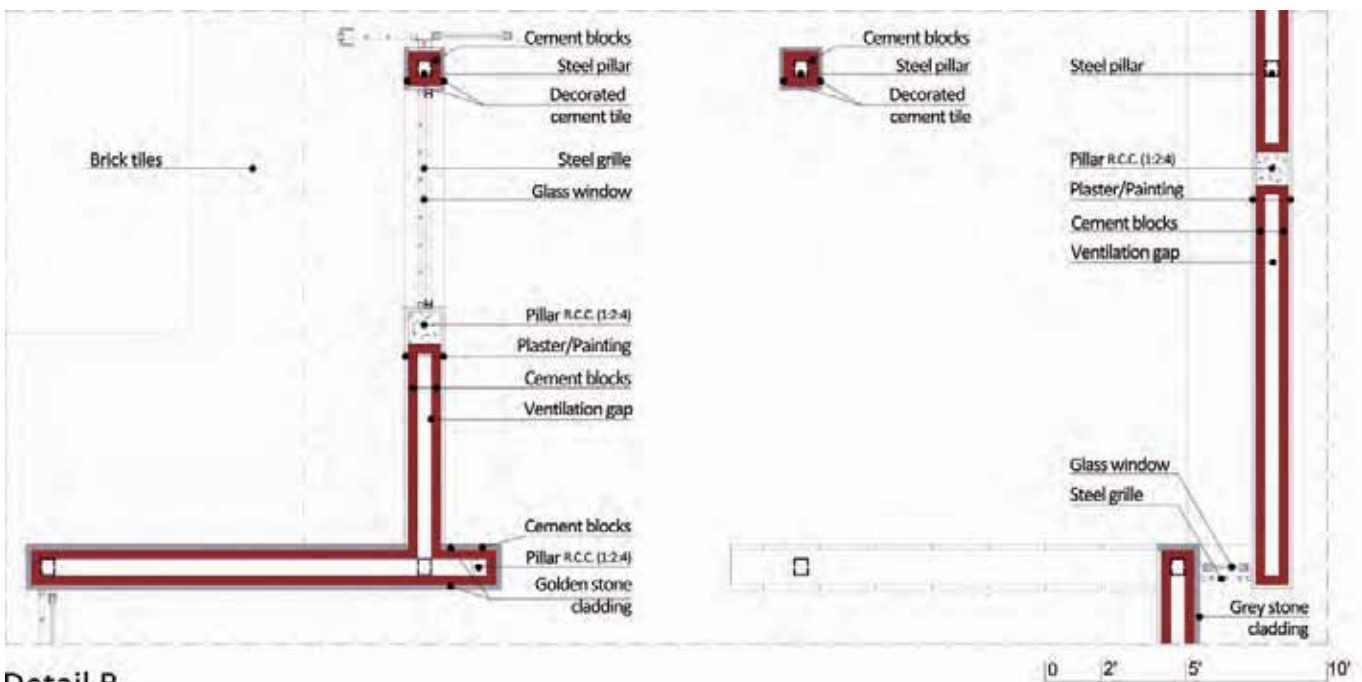
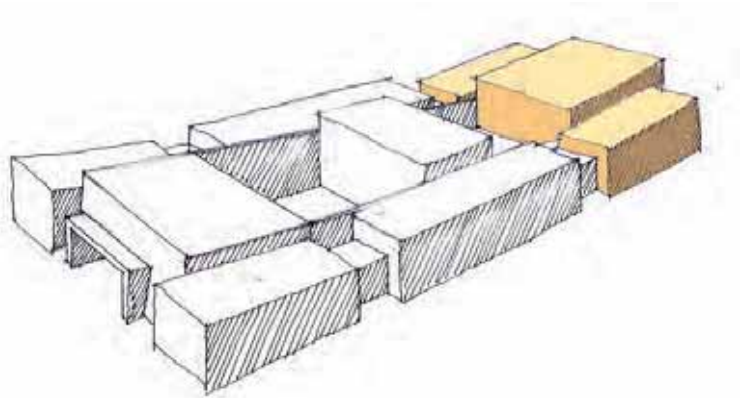


– **Block B**

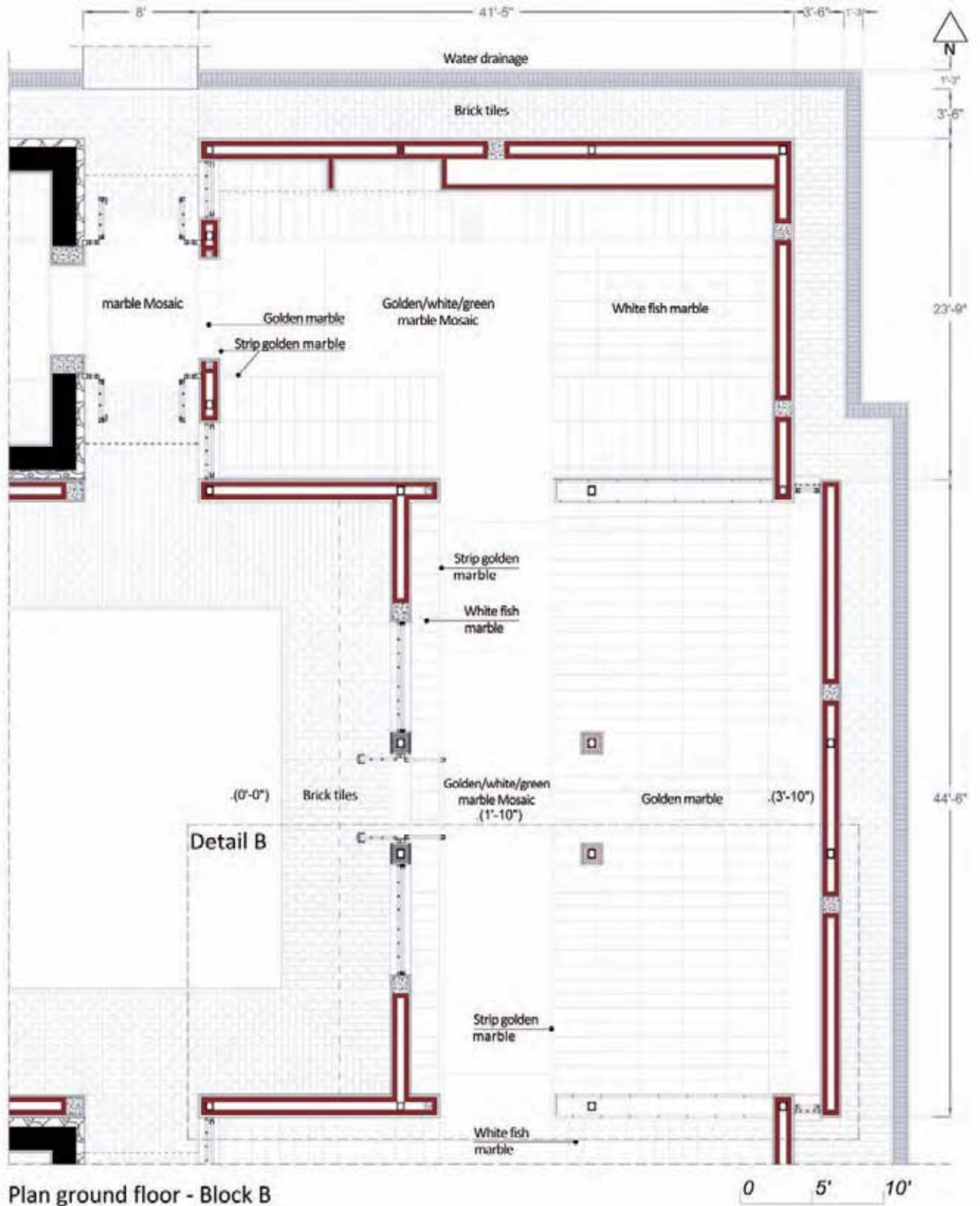
The B block, at the back of the Museum, consists of a central main gallery defined by two central pillars, and directly connected to the side galleries. The three blocks are not connected structurally, but present a symmetrical and compact form, designed to meet emergency situations.

The courtyards, centrally located, are secure areas, accessible from all parts of the Museum, so that in case of earthquakes or terrorist attacks visitors are able to converge there and, after danger is past, depart through the emergency exits.

The four passage nodules are positioned between the new blocks and the extant one, two at each side, creating a direct connection between galleries, courtyards and the outdoors.



**Detail B**



Plan ground floor - Block B

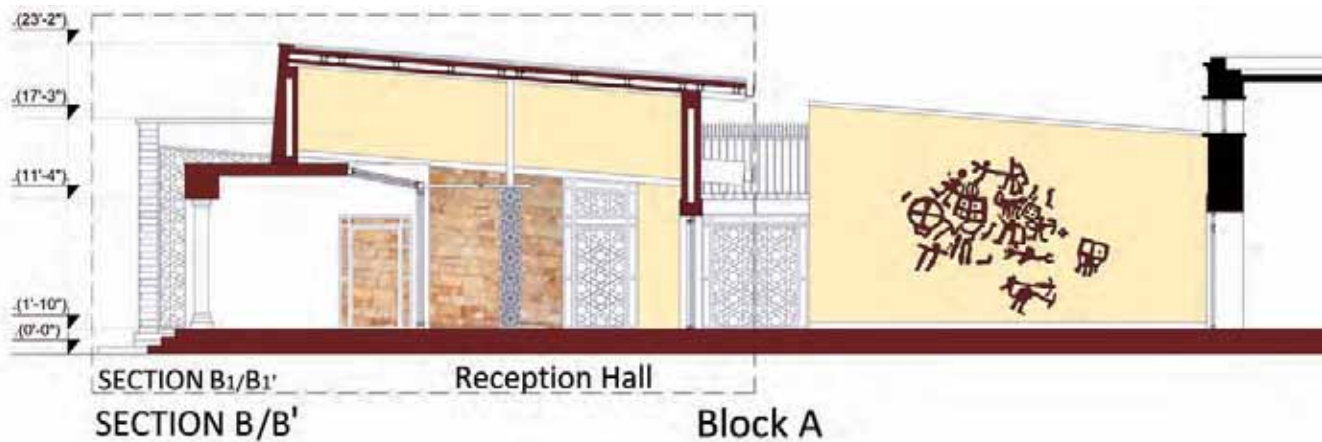
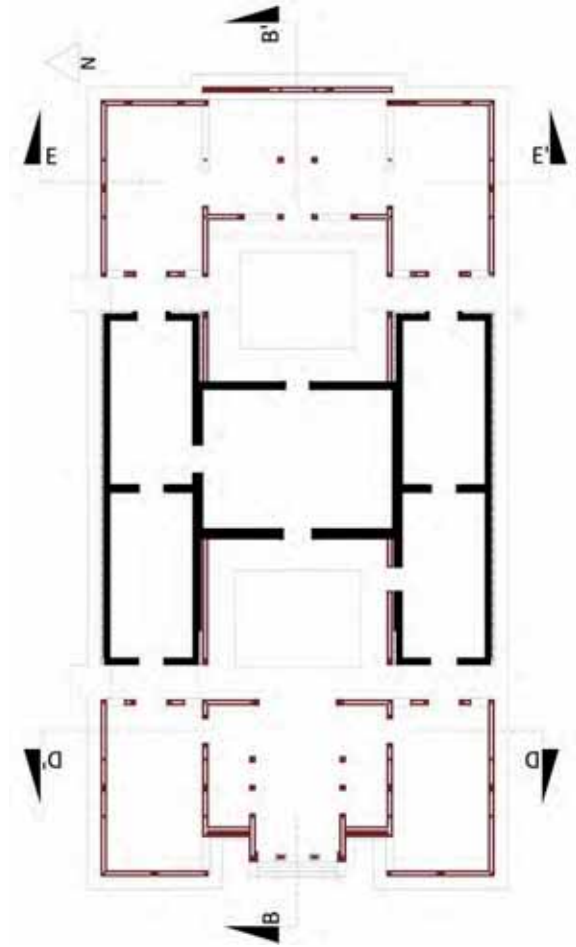
– Sections

While the new planimetrical distribution has been strongly conditioned by the extant H block, in the vertical section, the longitudinal in particular, the building states its own potential through the contraposition of its volumes.

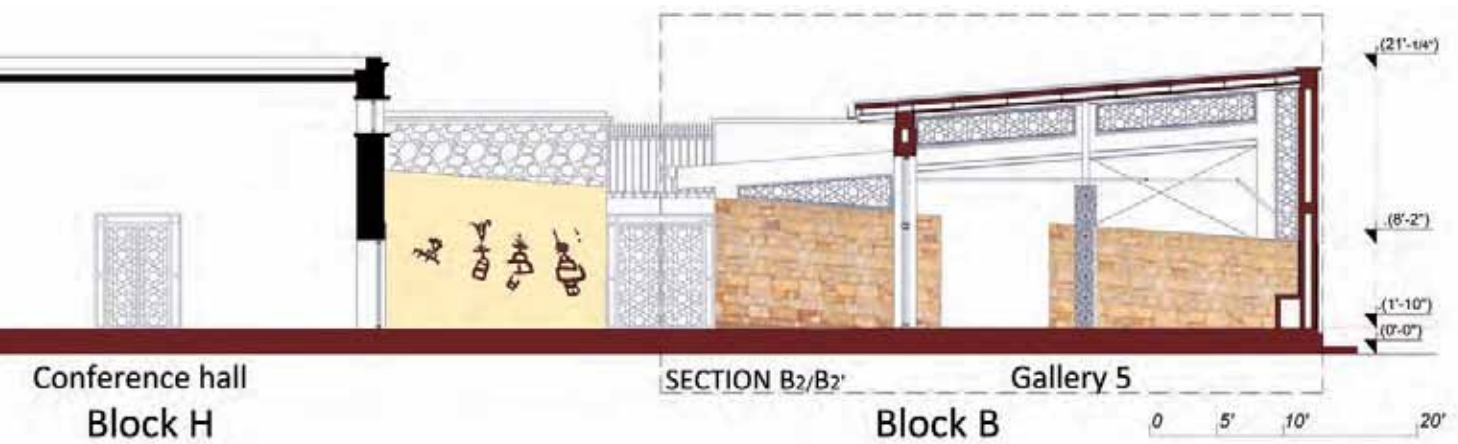
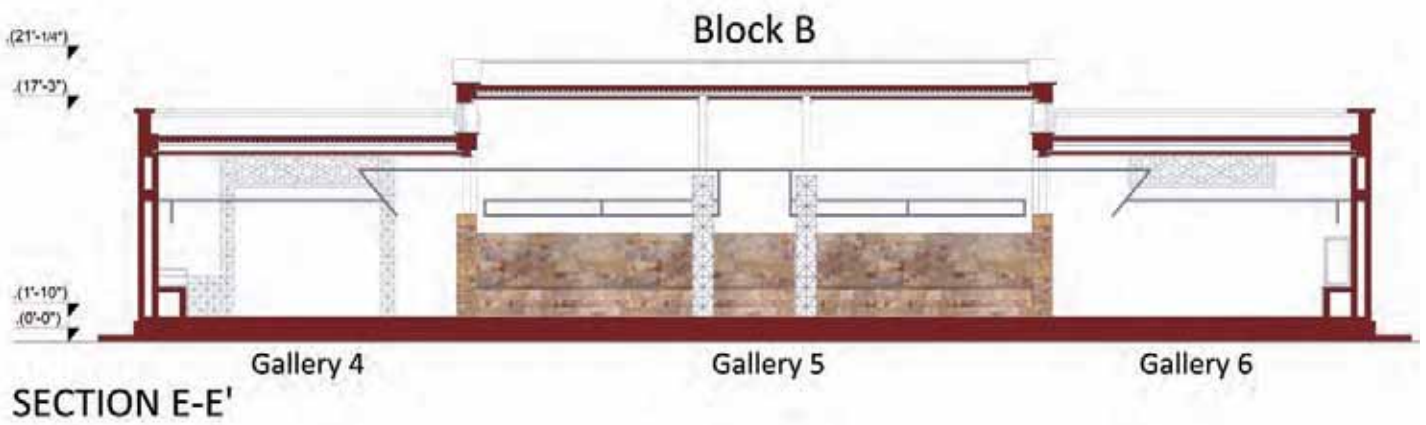
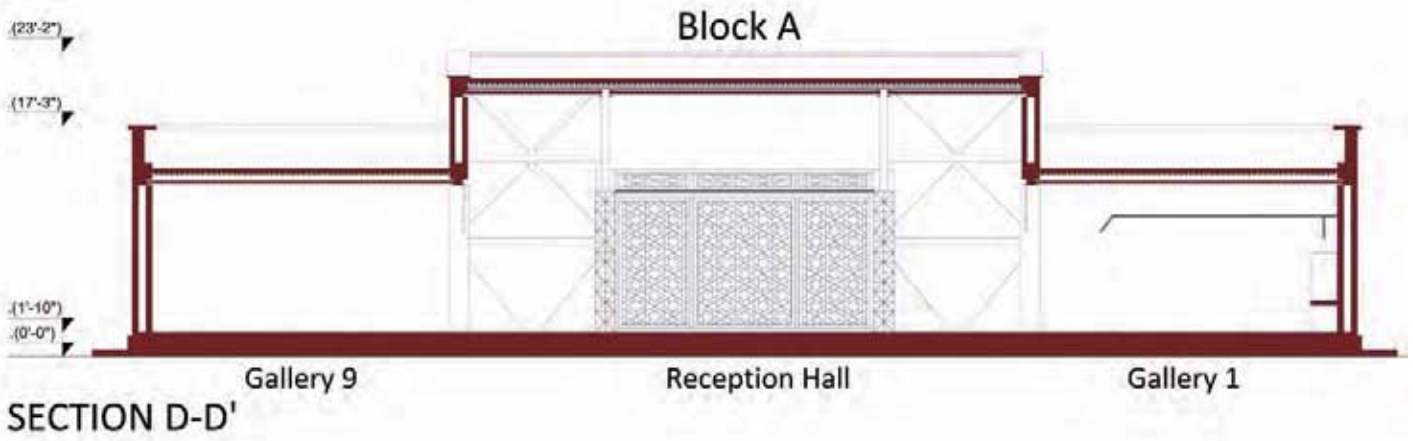
In the longitudinal section are immediately evident, both the visual communication between internal and external spaces and the integration between the new blocks and the extant block achieved by the slanted Wall. The Wall, asserting its strength in the central part of the façade of block A, runs through the two courtyards and gradually fades down in the B block, where the steel structure juts out of the columns, evidencing the metal core of the entire edifice.

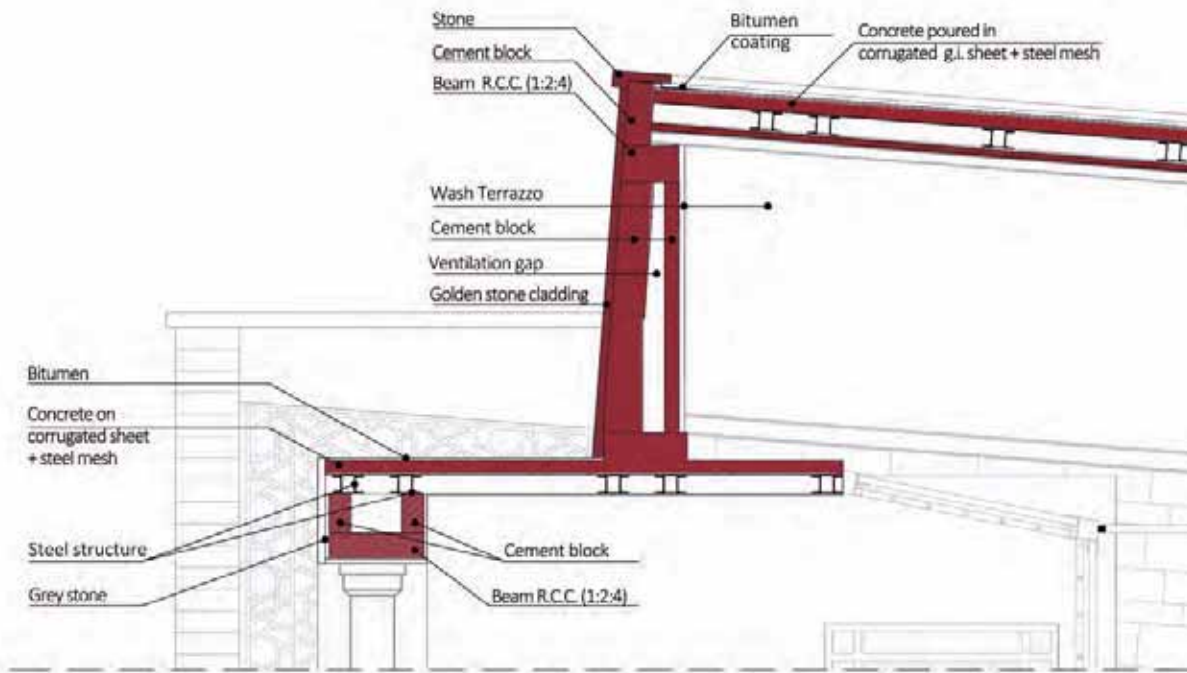
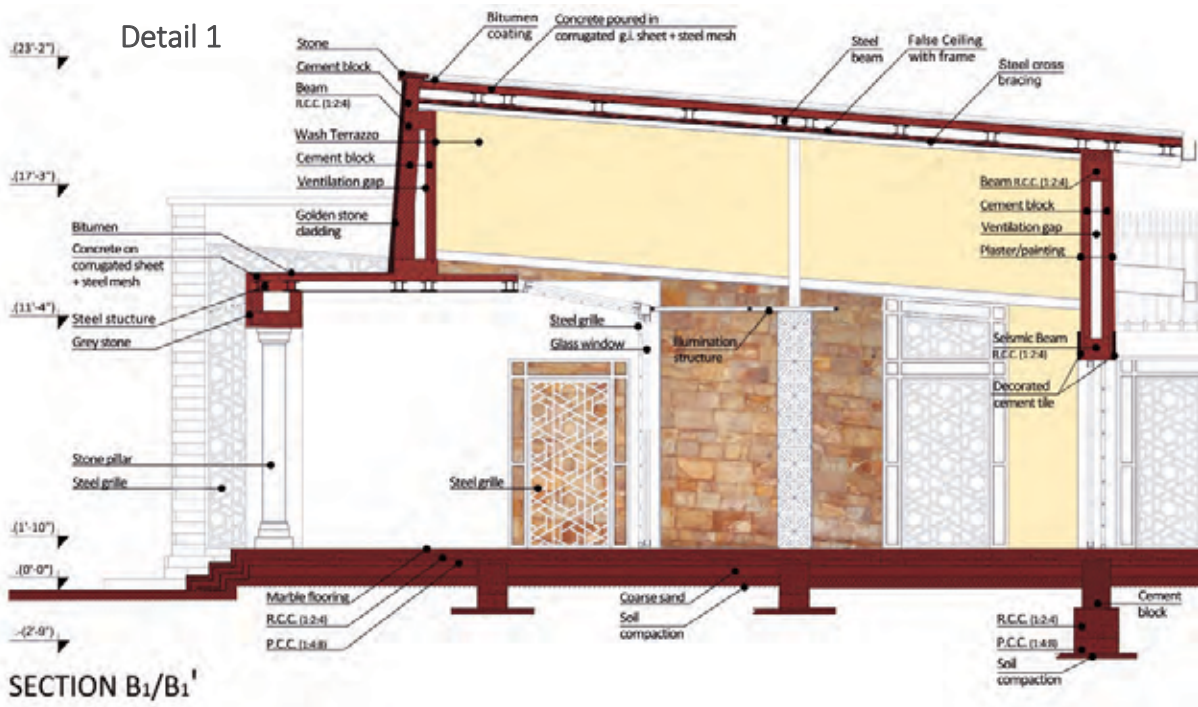
The golden stone Wall cladding in the reception hall and in the two courtyards is substituted by a painted *wash terrazzo* where it is carved with rock art bas-relief figures, and finally appears again in the second courtyard and in the B block, thus becoming integral part of the exhibits. Furthermore the alignment of the wide doorways allows an uninterrupted view of the sequence of internal and external spaces, from the entrance in the A block to the central gallery of block B.

Again, in the longitudinal section the contraposition of the different roof inclinations are clearly visible: in the A block the roof is orthogonal to the slant of the Wall; in the H block the existent roof is horizontal and finally in the B block the roof follows the inclination of block A but at an opposite slant. The contrast between the roofs, with their different heights and inclinations, is clearly visible in the courtyards. In particular, in the second courtyard, the existing wall comes out behind the slanted Wall, showing regular volumes in random rubble stone cladding.



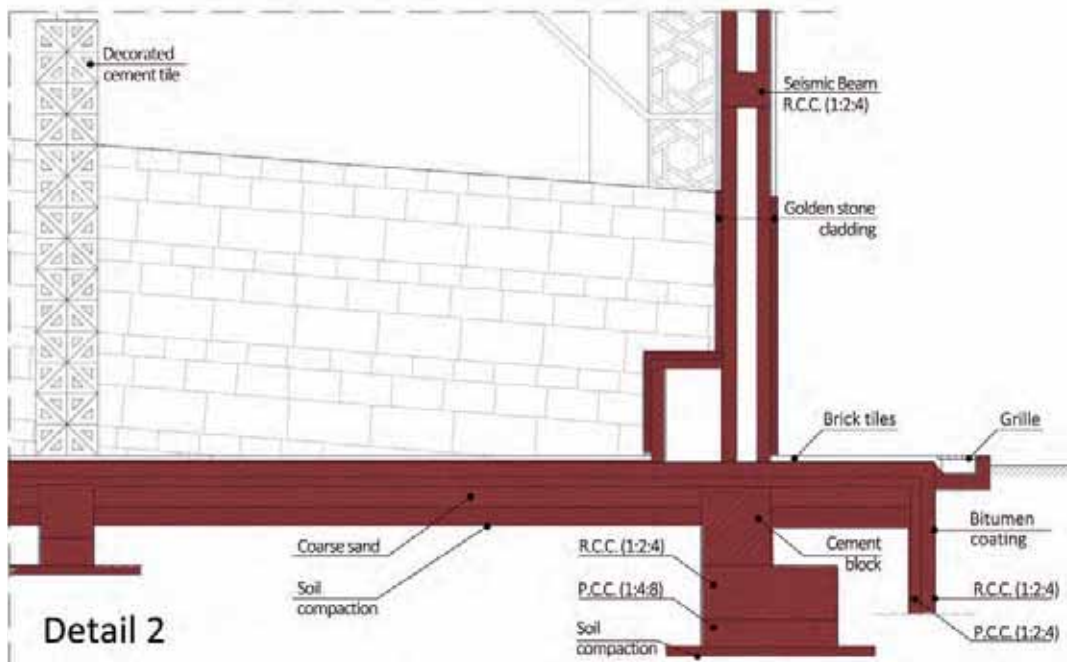
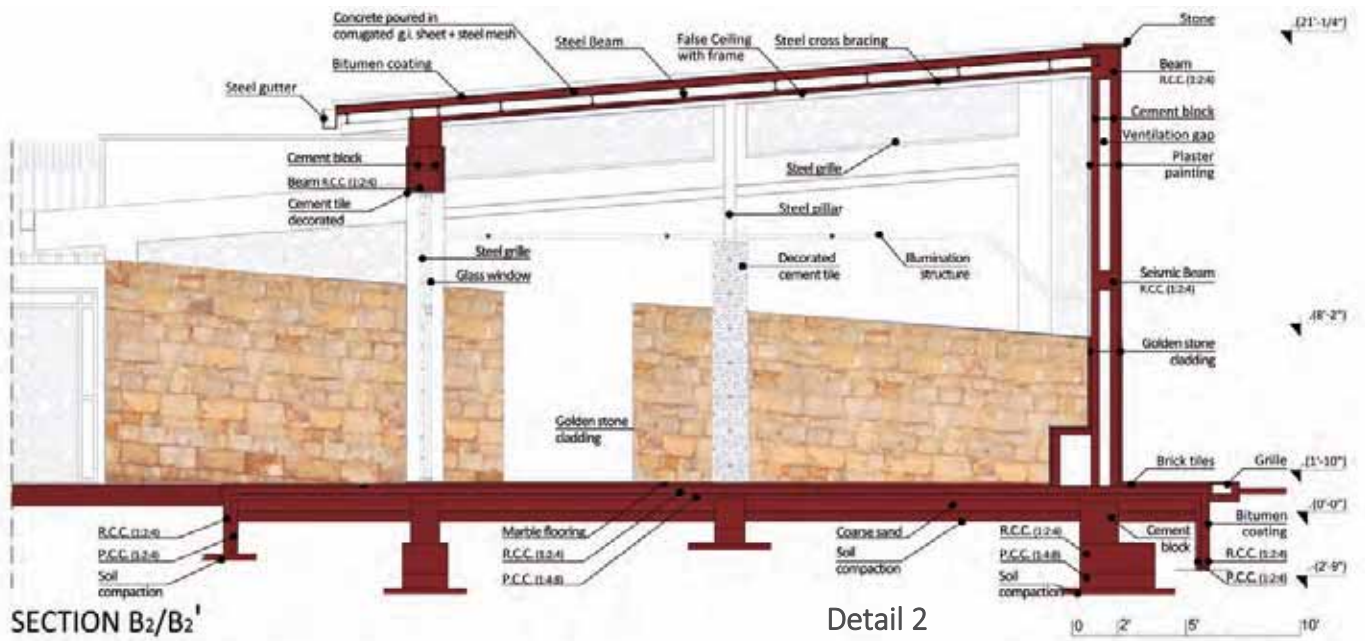






**Detail 1**

### 3. The New Swat Archaeological Museum





– **The Façade**

From the 70s on, construction styles in Saidu Sharif, and more generally in Swat, lost their connection with the valid construction practices of their own heritage. In addition, urbanism regulations that until that moment had guaranteed a certain degree of equilibrium between good architecture and urbanism needs, became more lax. During the last decades of the century there was an increase in constructions without any stylistic regulations, resulting in a confused and chaotic urban context, void of any adequate infrastructures.

The Museum, standing in a fenced compound of about 120,000 sqmt, is clearly visible from the main road, and consequently interacts immediately, on one side with some constructions built at the end of the 50s, and on the other side with crumbling buildings never completed, that inevitably degrade the urban context.

Furthermore the road, without sidewalks or drains, is littered with a jumble of electrical cables, metal advertizing boards, trash and refuse, cars, motorcycles, horses and often vividly colored trucks. To all, the New Museum replies with a monumental silence that permits the contemplation of the ancient and inestimable heritage of which it is the custodian. The façade is symmetrical and rational, and the central part, where the entrance is located, is higher and positioned at the back of the side volumes.



Main road in front of Museum



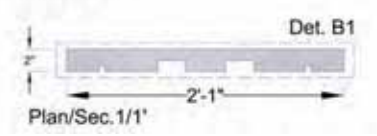
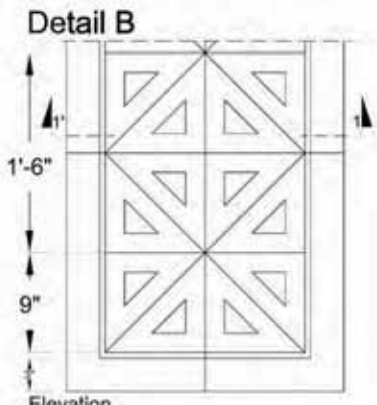
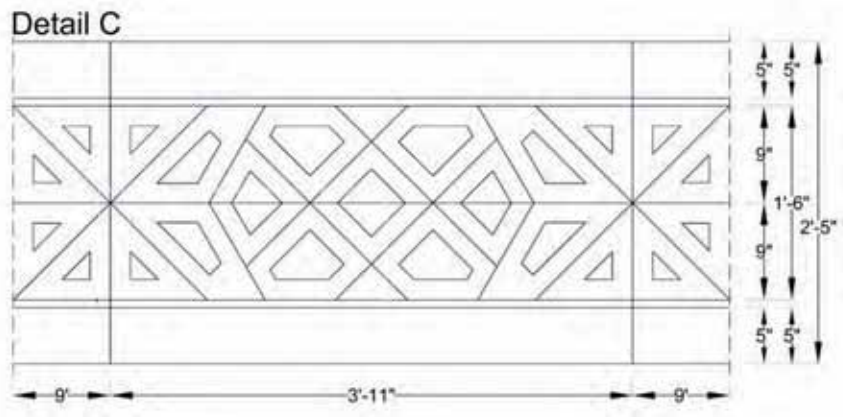
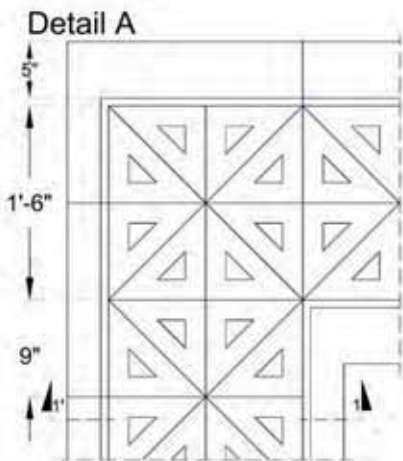
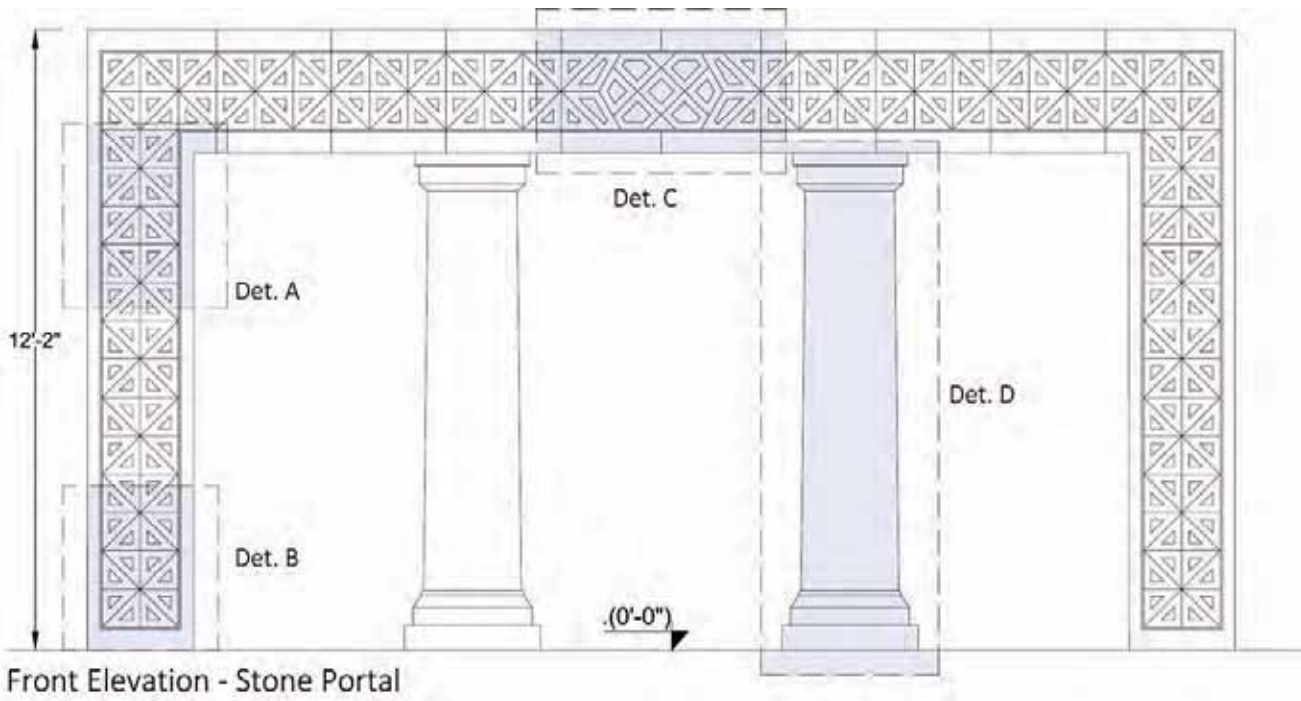


### 3. The New Swat Archaeological Museum

The cladding stones' colors have played an essential role in the composition of the façade: the contrast between the homogeneous grey stone of the side volumes, and the polychromatic golden stone of the central Wall, produces a captivating vibration for the visitor. The Wall's golden stone weaving is achieved by three rectangular lines of different dimensions, giving the ancient Gandharan walls a modern interpretation.

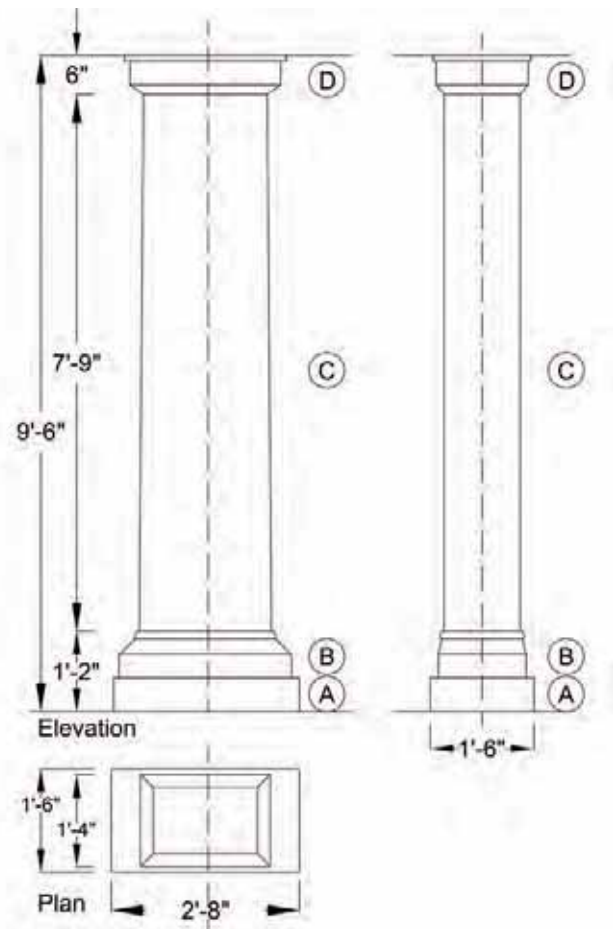
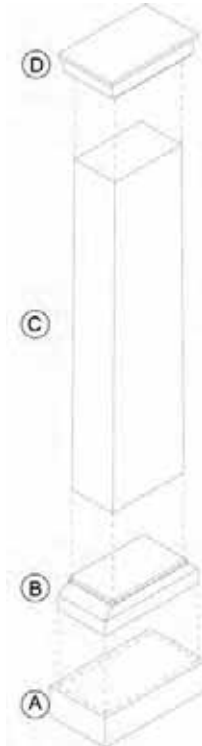
The entrance space is achieved by fitting a parallelepiped volume in the slanted Wall, framed by a portal that in the Islamic culture represents the moment of passage and the beginning of the journey (Mandel, 2007: 12). In our case it underlines the beginning of the journey to knowledge.



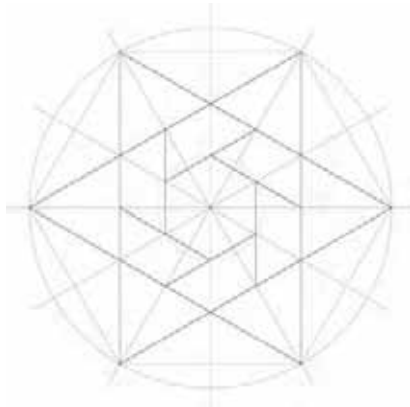


The portal in grey stones cladding is sculpted with Gandharan decorative pattern<sup>1</sup> while the parallelepiped is dressed with the same stones evenly cut.

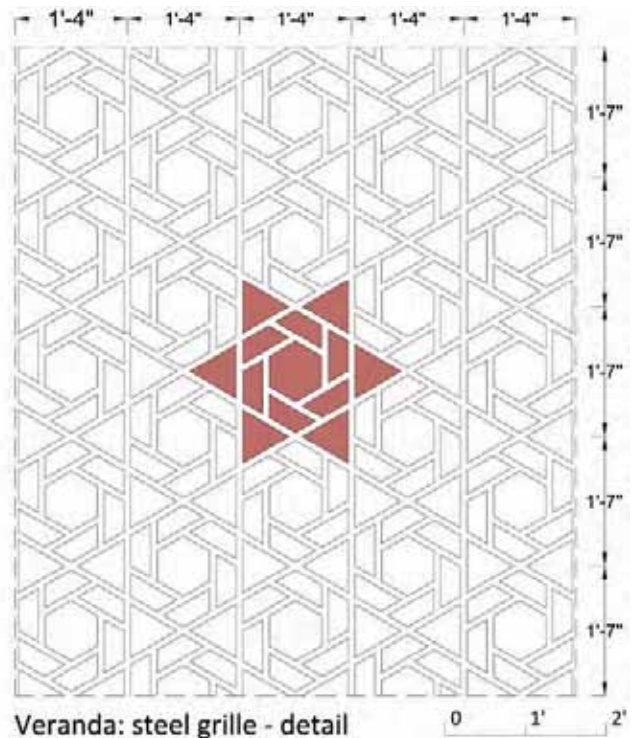
The portal is sustained by two pillars of rectangular base, built in light and sculpted grey stone, in a new interpretation of the form and dimensions of Gandharan pillars (*ibid*: 60).



The Veranda is enclosed in the back by a steel grille glass wall with an Islamic design<sup>2</sup>, composed by three figures: triangle, trapeze and hexagon, that make the rotated six pointed star. The same pattern has been used in all steel grilles in the doors and windows, modifying their dimensions as needed in a dynamic way.



The six pointed star in Islamic culture represents in the microcosm the six possibilities of motion in the six directions: north, south, east, west, nadir, zenith (Mandel, 2007: 8).





– Side and back elevations

The side elevations of the Museum are as discreet and quiet as the main façade. The height of the new volumes is aligned with the highest one of the extant block, and from these emerge the slanted Wall of the façade and the roofing of the volumes. For the purpose of equalizing the elevations, the walls' cladding of the new blocks are in lime grey stone, the same color as the existing block, but with a regular pattern contrasting with the existing wall in rubble stone masonry. The passage between blocks is underlined by the lower volumes, with steel bars antitrusion, of the emergency exits clearly visible through the steel grilles. Two weel chair ramps connect the emergency exits with the outdoors on the left side of the building.

The back elevation is totally enclosed in its symmetry, and, exposing the stone Wall that gradually lowers its height, becomes the base of the Wall. Like the façade, the central body is higher than the side volumes in grey limestone cladding.



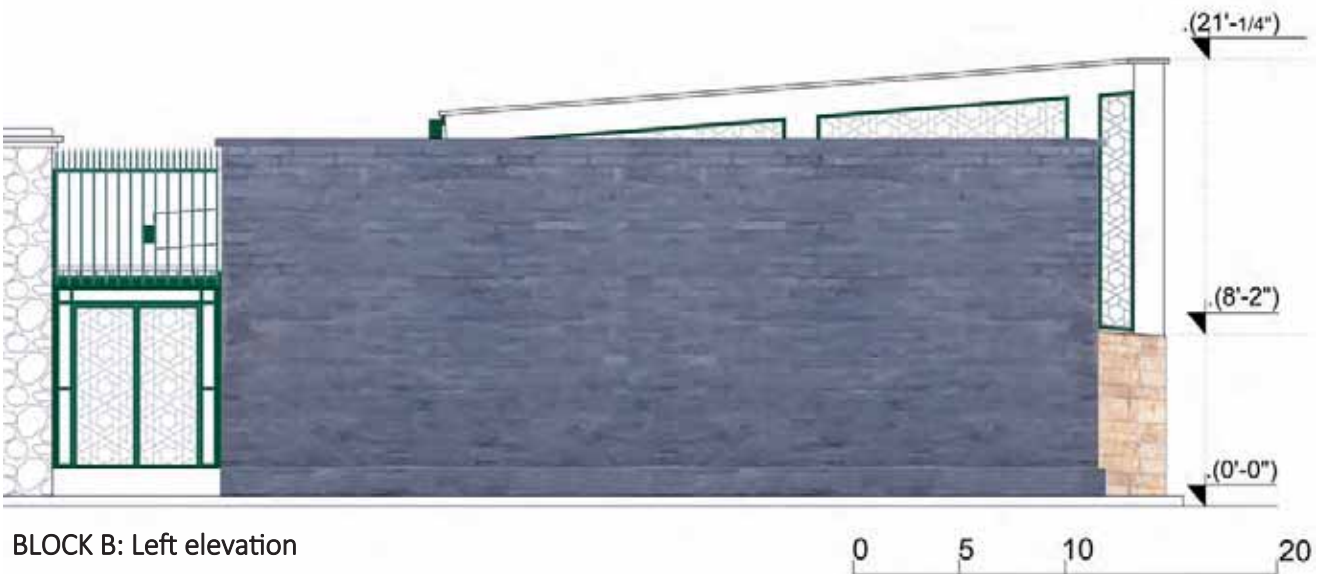
Left elevation



BLOCK A: Left elevation



3. The New Swat Archaeological Museum



## 3.2 Construction Technology and Structural Design

Due to the seismic high risk of Saidu Sharif, antiseismic structures were used in the construction of the Museum's new blocks. These steel structures were considered innovative in the context in which they were built. They were designed in collaboration with prof. engr. C. Cristilli and AIRES, in an integrated process with architectural design. The result of this endeavor was very comprehensive and detailed, but, given the inevitable design difficulties in the absence of an exhaustive knowledge of the building codes and of the building industry in Pakistan, the UET was asked to revise the project and to advise over needed changes and finally to perform a vetting of the architectural and structural drawings. At the end of the entire project in June 2011 was discussed with DOAM and approved.

### 3.2.1 Construction Technology

Several factors were considered in the design of the construction technology to be implemented in the new blocks of the museum. Generally speaking, in Pakistan it is not easy to build a valid concrete structure. This is due to the low quality of the materials used, the lack of qualified workers, and the difficulties in regularly monitoring the site, particularly on high-risk security zones.

In order to avoid such problems a steel structure was designed, made of beams and pillars prefabricated in workshops, and encased between two layers of cement blocks. The metal structure ensures a good resistance to seism both because of the quality of materials and the quality of manufacture, monitored and controlled in the workshops.

The foundations are realized with concrete plinths interconnected by R.C.C. beams. A concrete protective plinth was placed around the edifice, to avoid any water seepage in the foundations.

The primary steel structure is composed of steel pillars and beams welded; the pillars are encased in the reinforced masonry wall that consists of two vertical layers of cement blocks joined transversally every four blocks, and reinforced horizontally with a steel grid every three rows. In between the two layers there is a gap, that, running along the entire perimeter of the edifice, allows for an air flow along the masonry walls and an adequate thermal insulation for all the Museum's internal spaces. Furthermore, to control the shifts of the steel structure and to strengthen the masonry, R.C.C. pillars (both to divide the wall in two part on the horizontal plan and in correspondence of all openings) were introduced together with a R.C.C. seismic beam and a R.C.C. tie beam at the end of the masonry wall, over which rest the roof primary steel beams.

### 3. The New Swat Archaeological Museum



Since October 2006, the authors started to experiment with this innovative antiseismic structure as an alternative to reinforced concrete, for the post-earthquake reconstruction of 7 Primary Schools in the Balakot Area, Pakistan<sup>4</sup>. After an initial assessment it was evident that the main cause of the disaster was a complete absence of earthquake resistant structures. In addition, constructions in reinforced concrete were realized with an improper execution using sub standard materials. Considering the local resources in terms of materials and a paucity of qualified workers, an innovative but simple earthquake resistant structure was designed in cooperation with prof. engr. C. Cristilli. The proposed technology consisted of an earthquake resistant platform as foundation, with R.C.C. plinths connected by steel beams, and main steel structures encased in two layers of cement. This technology was selected in order to reduce the time of execution and monitoring on site. In fact several structural elements have been prefabricated in workshop, insuring adequate quality in materials and execution. This experience was the started point of the earthquake resistant structure in the two new blocks of the Swat Archaeological Museum.

The roof structure is composed of primary and secondary steel beams properly welded to both pillars and to each other. In addition the roof structure is reinforced by steel cross bracings that follow the slated roof. The roofing consists of C.G.I. sheets, fixed on the secondary steel beams, on which it is placed a cement slab reinforced by steel mesh, as a defense against intrusions<sup>5</sup> as well as against partial roof collapses during seismic events. The roofing is completed by a bitumen coating. The roof is hidden on the inside by a false ceiling, whose frame is directly connected under the secondary steel roof structure, allowing air flow under the roof and a clear view of the primary roof structure.

The structure of the four passage nodules (emergency exits), located between existing and new blocks, was designed to be independent from the structure of the existing block and function as an expansion joint. The steel structure is in small pillars and beams; the roofing consists of C.G. I. sheet insulated by glass wool placed in a wooden frame reinforced by a metal mesh that acts as a defense against intruders.

### 3.2.2 Structural Design\*

*by Claudio Cristilli and AIRES Ingegneria*

In the reconstruction and rehabilitation project of the Swat Archaeological Museum of Saidu Sharif and in particular of its new primary structure, several design and executive requirements were considered:

- to individuate the pre-existing and structural elements that could be reused after any eventual maintenance or reinforcement;
- to move minimal quantities of materials around the area, and to use materials produced and manufactured with both low and high technologies, beside, of course, materials specific to local traditional use. This need has been a constant for every design and execution process;
- to reduce the size of structural elements in the internal spaces and to have a regular and modular pattern;
- to ensure that the new elements introduced in the structures be as light as possible, both in their structure and in their completion, in order to minimize the damages caused by eventual future seismic events.

In the structural design, particular attention was given to local seismic activities. The site is, in fact, located about 100 km from the epicenter of a strong earthquake, measured at 7,6 on the Richter scale that hit Kashmir and North Pakistan on October 8, 2005. That earthquake was felt as far as 1000 km away, while serious damages occurred inside a radius of 150 km, therefore including the Swat Museum. Before the earthquake of 2005, Pakistani regulations had been untouched since 1986, and were based on the American Uniform

Building Code (UBC) of the same period.

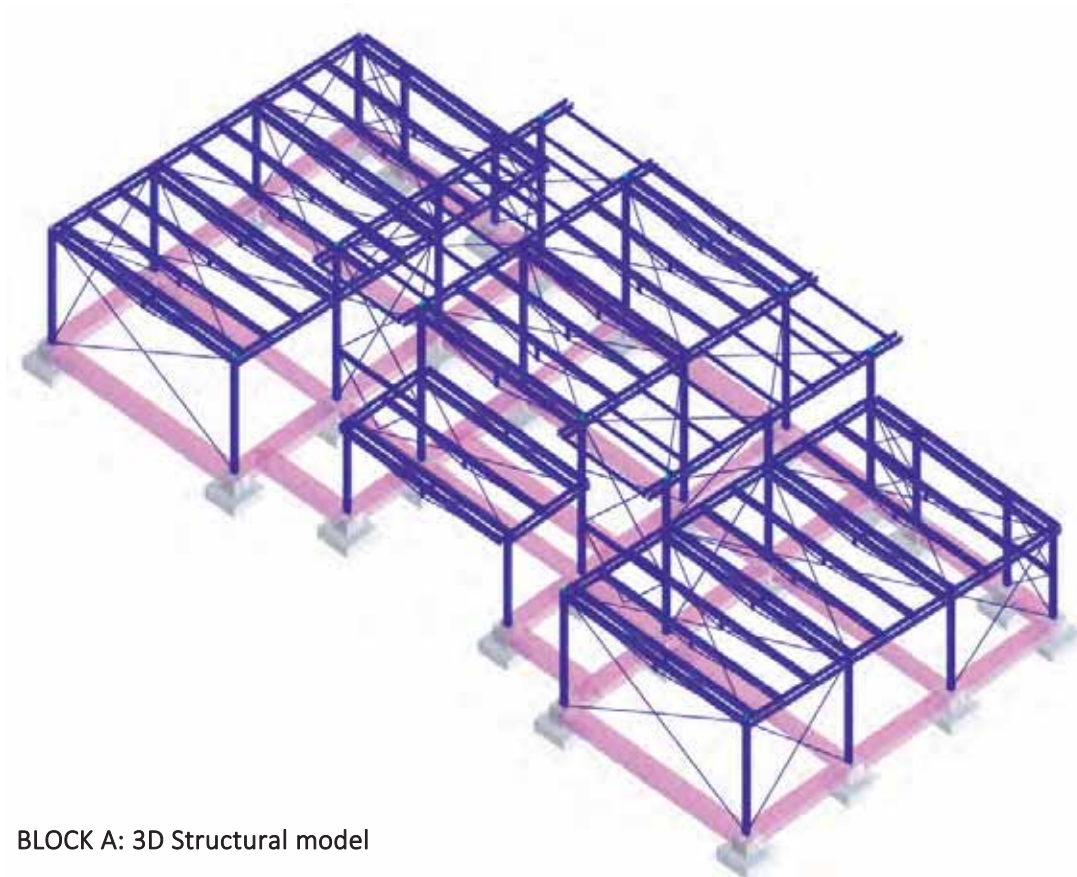
After the earthquake the Pakistani regulations were amended following the approval of new technical regulations “Building Code of Pakistan – Seismic Provisions 2007”, this time entirely consistent with the new seismic regulations according to the UBC 1997, in which the analysis methodology is quite similar to actual Italian regulations.

For this purpose, the analysis method called “Seismic response spectrum analysis”, the prevalent method in use in order to analyze the effect of horizontal forces on a structure, was implemented in the seismic design, referring to the zoning of the site of Saidu Sharif as a high risk seismic zone.

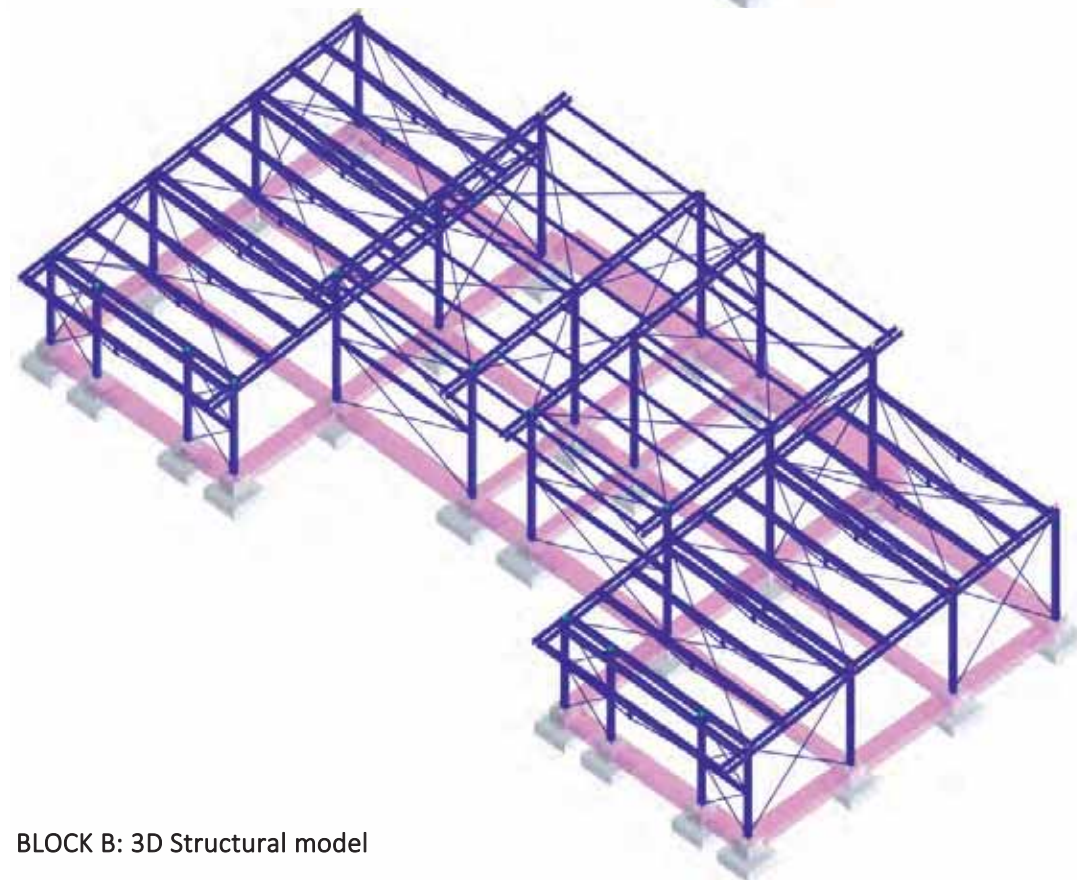
Therefore, according to the parameters specified above, for the realization of the primary structure in the reconstruction and rehabilitation of the Museum building, the following structural parts were executed:

- **Shallow foundations**, of the “plinth” type, in R.C.C., following local technical regulations in their proportions and dimensions. In order to reduce the depth of the excavations and the use of cement, the former were executed almost exclusively in correspondence of (each) plinth; on each plinth was placed a R.C.C. pillar, moderately tall, at the top of which was placed the steel plate bearing the steel column. It was possible, in this way, to reduce the excavation, as well as to have a strong horizontal connection offered by R.C.C. beams, built between the tops of the pillars;

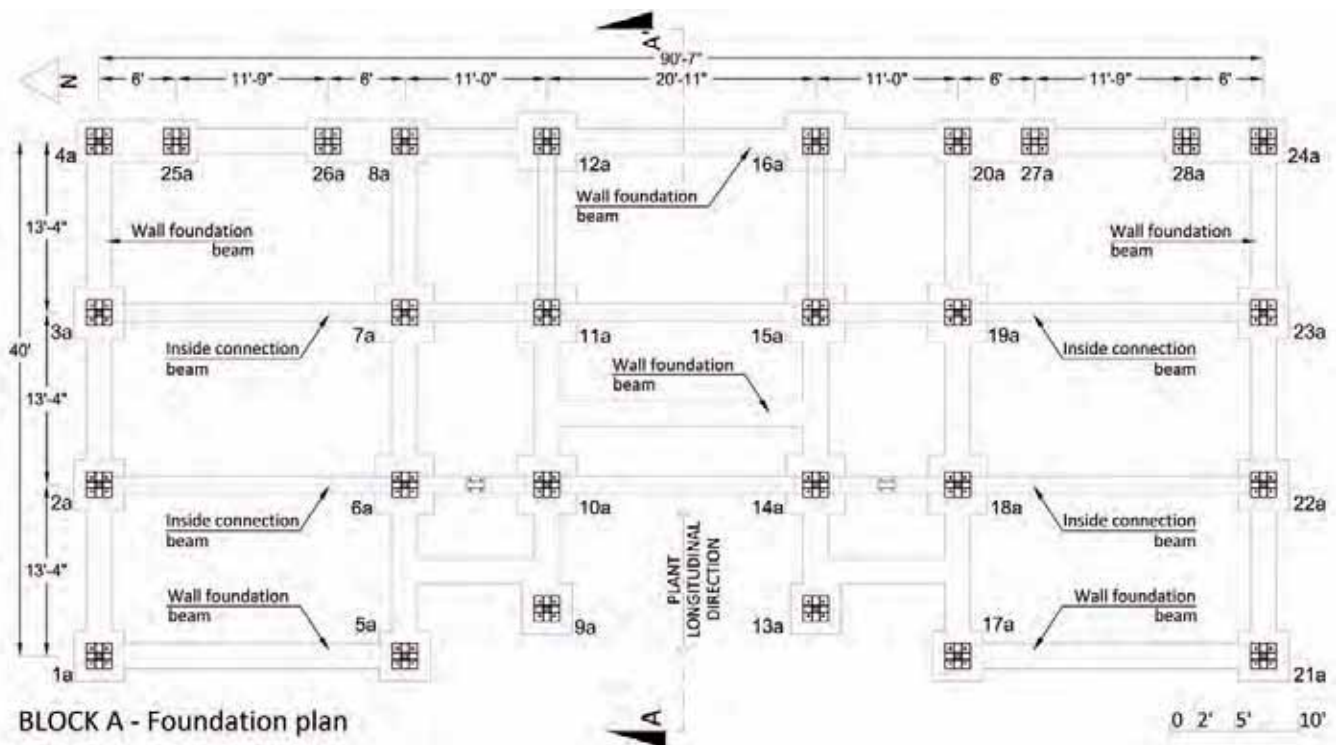




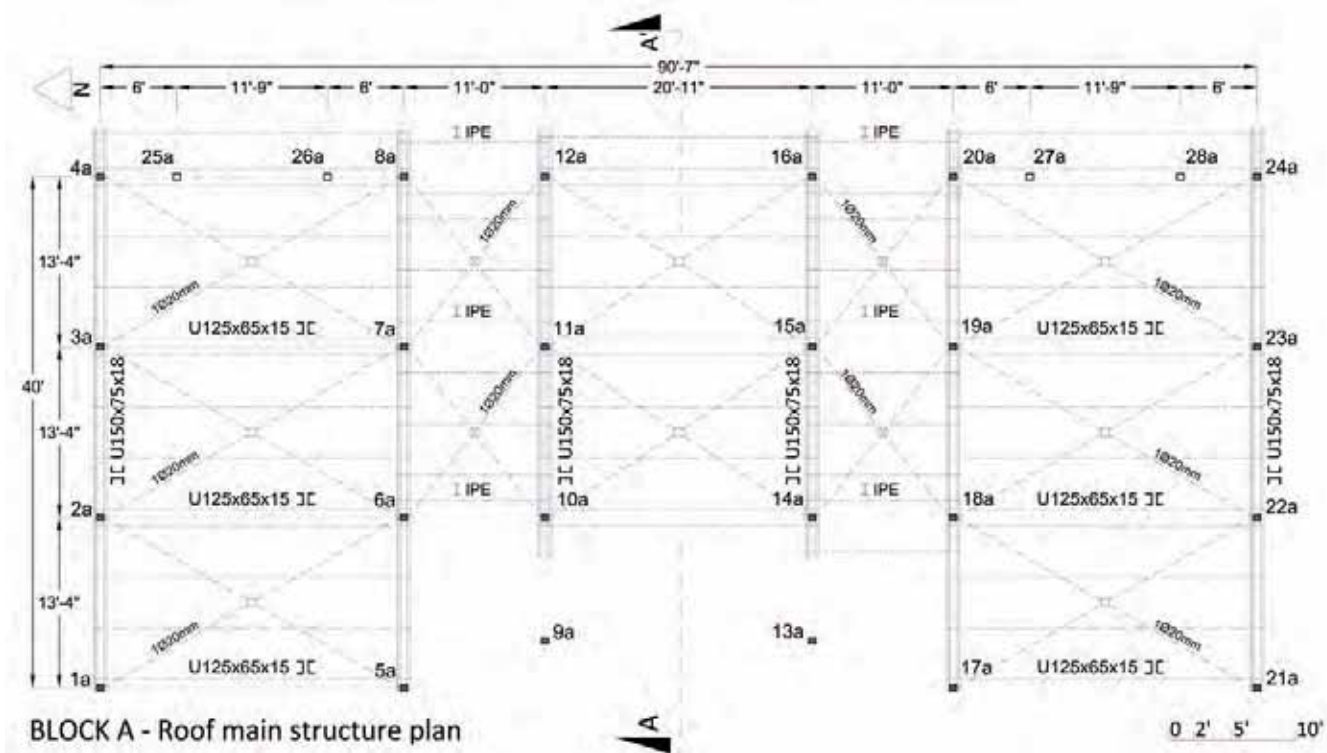
BLOCK A: 3D Structural model



BLOCK B: 3D Structural model



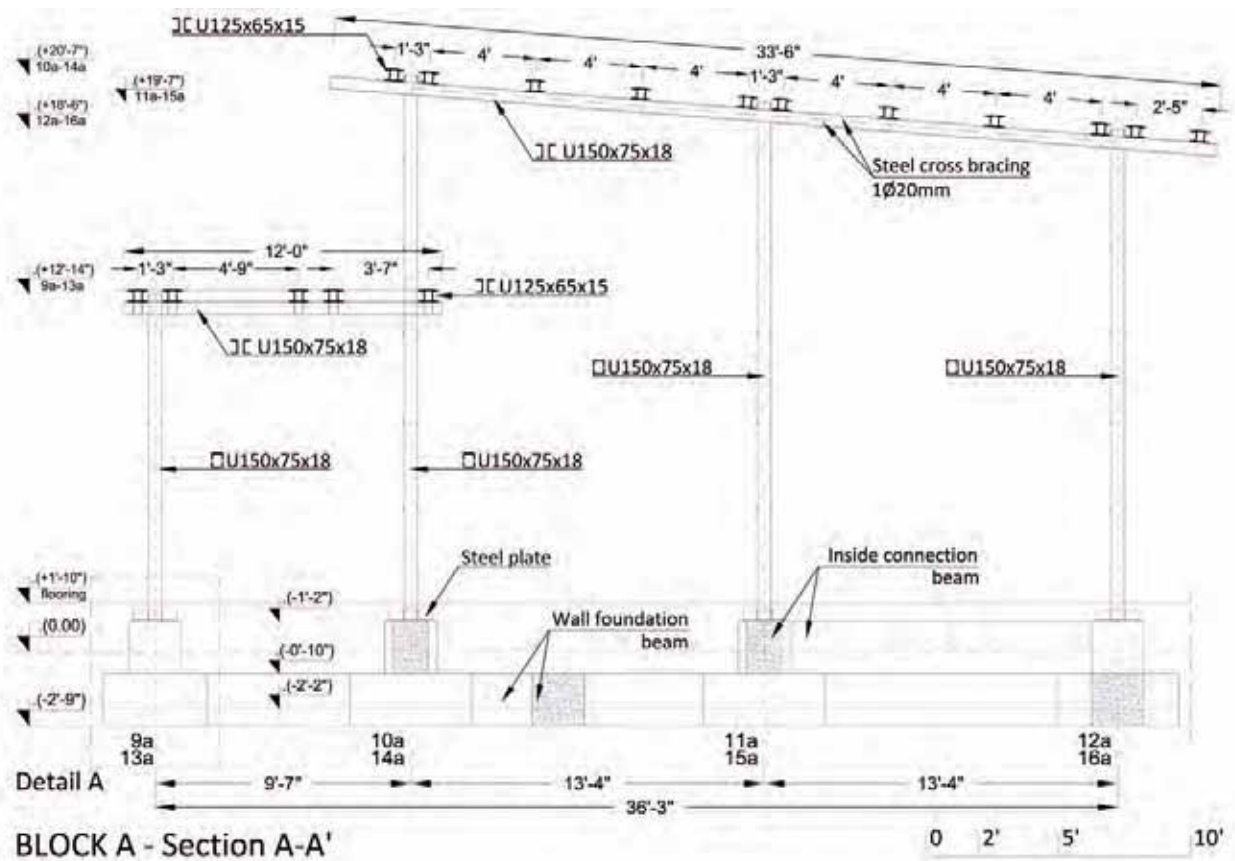
BLOCK A - Foundation plan



BLOCK A - Roof main structure plan

| LEGEND           |                            |
|------------------|----------------------------|
|                  | Main beams JC U150x75x18   |
| Supported beams: |                            |
|                  | JC U125x65x15              |
|                  | I IPE127x76x13             |
|                  | Steel columns U150x75x18   |
|                  | Steel cross bracing 1Ø20mm |

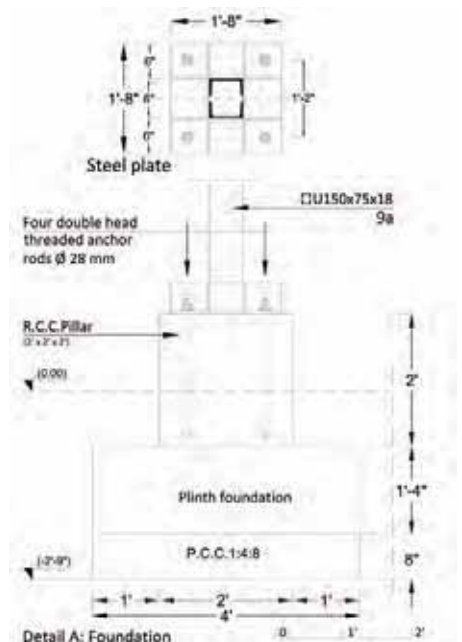
\* In this section all drawings are by C. Cristilli and AIREs Ingegneria



the steel plates bearing the columns have been thus located immediately under the ground floor level.

R.C.C. beams, connecting the bases of pillars (and foundations) to each other, have been moreover used as foundations for all external and internal walls, offering also a grid configuration for the pouring of R.C.C. underneath the ground floor.

- The **primary steel structures** were made using coupled U profiles assembled on the shorter side (for the pillars, the main beams and the secondary beams for the space with wider span), and the double T profiles (for the secondary beams of shorter span). The connection between the coupled profiles was achieved by welding steel plates; the connections between steel structural elements were also welded together. Steel pillars were encased in non-structural cement casting in order to protect them from fire and oxidation. In addition, the steel structure ("beams and steel pillars") was connected by steel bar cross-bracings (at the junctures). These structures, both vertical and slanted (in the case of the roofs), allow for a minimal horizontal movement at the junctures. They also counteract any instability mechanism of the pillars during a seism.
- The **roof design**, realized by covering the corrugated steel sheets with unreinforced cement casting, offers a marked reduction of the vertical load in each pillar.





## Technical Notes

This technical notes briefly describe the assumptions underlying the structural design of Block A and Block B of Museum building.

All structural checks and assessments for structure designs shall be done at Limit State Method (Service = SLE, Ultimate= SLU) in accordance with the codes defined as follows:

*For seismic analysis:* Italian Technical Rules for the Constructions - D.M. 14/01/08 [in particular Safety (chap.2), Actions on the constructions (chap.3), Design for seismic actions (chap.7)]

*For structural checks:* Eurocode 2 UNI EN 1992-1-1 November 2005, corrected April the 6th 2006  
Eurocodice 3 UNI ENV 1993-1-1:1994, Eurocodice 3 UNI EN 1993-1-1:2005, Eurocodice 3 UNI ENV 1993-1-3:2000, Eurocodice 3 EN 1993-1-8:2005

### Loads

#### – Weight load

The weight load according D.M. 14-01-08 is divided in structural load and borne dead load (for example roof load).

The structural load and borne dead load have been evaluated in 25 + 25 daN/sqm. For roof elements (besides the weight of structural elements that is assigned directly by the software).

It has been evaluated the weight load due to R.C.C. beam and the above wall equal respectively 200 daN/m. (structural weight) and 300 daN/m ( borne dead load).

#### – Snow load

Snow load has been considered in 95 daN/sqm. (20 lbf for square feet).

The snow load has been attributed to the single secondary beam as linear load (weight per unit length); this linear load is equal to 115 daN/m since the distance between secondary beams is approximately 1.20 m.

#### – Wind load

The basic wind velocity has been considered equal to V= 31 m/sec. (70 miles per hour ).

According to the D.M. 14-01-2008 starting from wind velocity we proceed to evaluate reference kinetic pressure qb equal to:

$$q_b = \frac{1}{2} \rho \cdot v_b^2$$

equal to: to the D.M. 14-01-2008 b= 60 daN/sqm.

The wind load has been considered to be applied to the extremes of the columns (top and bottom, the latter, on the plinth, is negligible). The influence area of each ex-

treme has been evaluated in 5 sqmt. Therefore the force for each node is equal to 300 daN (upwind direction) and 150 daN (downwind direction). The wind force is applied in X and Y direction.

#### – Seismic Load

According to the D.M. 14-04-2008 a modal linear dynamic analysis has been used for the seismic load.

The seismic zone has been chosen having a PGA of approximately 0.3 g. The soil is type "C" (according D.M. 14-01-08) similar to SD according UBC97.

Parameters for choosing coefficient and other chart value in Italian DM 14-01-2008 are listed below (reference to chapter 2 of the DM):

- Nominal life of the structure : VN = 50 years;
- Execution classes : III class (important and relevant structures, generally government offices, etc.)
- Coefficient for evaluating reference period for seismic action: CU = 1.5;
- Reference period for seismic action: VR = VN x CU = 50 x 1.5 = 75 years.

To evaluate the horizontal elastic response spectrum the following parameters were found:

| Limit state | Pvr(%)       | Tr(years) | Ag/g   | F0    | Tc*(sec) |
|-------------|--------------|-----------|--------|-------|----------|
| SLO         | Default (81) | 45        | 0.0632 | 2.504 | 0.266    |
| SLD         | Default (63) | 75        | 0.0904 | 2.434 | 0.282    |
| SLV         | Default (10) | 712       | 0.3384 | 2.308 | 0.45     |
| SLC         | Default (5)  | 1462      | 0.4817 | 2.334 | 0.506    |

ag/g: maximum horizontal ground acceleration (return period 50 years)

F0: maximum spectrum amplification factor

T C \*: corner period at the upper limit of the constant acceleration region of the elastic spectrum

SLO: OPERATIONAL (Service State)

SLD: DAMAGE (Service State)

SLV: LIFE SAFETY (Ultimate State )

SLC: COLLAPSE (Ultimate State)

The seismic vertical component has been not considered.

For more details on response spectrum please refer calculation reports or Italian Code D.M. 14-01-08

#### – Thermal load

To take into account the solar radiation, we consider a temperature difference equal to 15° on the roof structural elements.

#### – Load Combinations

For more details on load combinations please refer to calculation reports or Italian Code D.M. 14-01-08.



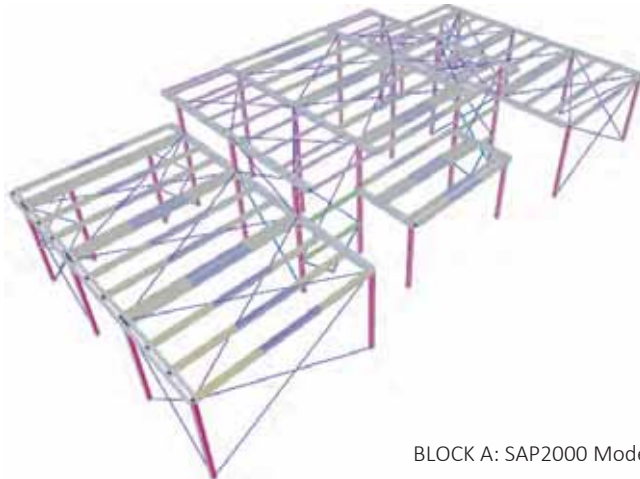
### 3.2.3 Design and Vetting of Two New Blocks

*by Mohammad Ashraf*

The new blocks proposed in a unique steel structural system with infill block masonry wall, were vetted by UET, which suggested some changes as per local and architectural requirements. Three-dimensional finite element based software, SAP2000<sup>6</sup>, was used for vetting purposes. The model was subjected to wind load, earthquake load, snow load, live load and self load of the structure.

By and large, the structural design made by prof. eng. C. Cristilli and AIRES was found adequate, apart from some information missing in the structural drawings, e.g. reinforcement detail of the horizontal seismic band and the slab of the entrance veranda, the connection detail of galvanized iron sheet with secondary beams, the detail of rain water steel gutter, etc.

Recommendations from Vetting



BLOCK A: SAP2000 Model (Drawing by UET)

Based on the shortcomings in the design and the architectural requirements, the Consultancy Cell at UET Peshawar recommended the following modifications in the proposed structural design:

- To replace the proposed tie rod arrangement with two steel plates (10" wide and 3/8" thick) applied at the middle third portion at both top and bottom of the double channel section;
- To strengthen the long infill masonry walls by the introduction of R.C. vertical confining elements (fig?.);
- To provide the R.C. confining elements on both sides of openings (fig. );
- To connect the plinth protection with the reinforcements of the floor system and also to provide a R.C. cut-off wall at the outer end of the plinth protection;
- To provide confining elements in the architectural slope walls.
- To replace the three hole blocks with 2-hole hollow blocks or preferably solid blocks of the same size for the construction of the wall.

All the changes were incorporated in the structural design and new drawings were produced and vetted by UET on November 5th2011.



Old façade: Selective demolition (photo by E. Loliva)

### 3.3 Reconstruction and rehabilitation: execution process

The construction works were divided in four different tenders and respective sub-activities, and the different groups of preselected companies were invited for each tender<sup>7</sup> separately.

In chronological order, the four construction clusters were:

- a. Selective demolition;
- b. Foundations and elevation structure;
- c. Retrofitting of the existing part of Museum building;
- d. Completion of the finishing work.

The technical and financial proposals were evaluated by ACT and DOAM Representatives. UET, having a considerable experience in the monitoring of construction work with government and international partners, was asked to perform daily monitoring, in the person of engr. Zarif Khan of Peshawar under the supervision of prof. engr. (PhD) Mohammad Ashraf, in all phases of the construction clusters. In addition, regular monthly visits were made by arch. I. Marati for further monitoring.

The works started with a selective demolition in November 2011 and were concluded in June 2013, including the exhibit displays.

## Time table of executed works

|          | Activity  | Company                  | Nov-11 | Jan-12 | Mar-12 | May-12 | Jul-12 | Aug-12 | Sep-12 | Nov-12 | Jan-13 | May-13 | Jun-13 |
|----------|---|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>a</b> | <b>Selective demolition;</b>                          | Javed Construction       |        |        |        |        |        |        |        |        |        |        |        |
| <b>b</b> | <b>Steel, concrete structure and masonry work</b>     |                          |        |        |        |        |        |        |        |        |        |        |        |
| b1       | <i>Foundation in RCC completed</i>                    | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| b2       | <i>Primary, secondary and roof steel structure</i>    | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| b3       | <i>Masonry work</i>                                   | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| b4       | <i>Roof in cement</i>                                 | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| <b>c</b> | <b>Retrofitting of the existing part of building;</b> |                          |        |        |        |        |        |        |        |        |        |        |        |
| c1       | <i>Application of ferro-cement overlay;</i>           | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |
| c2       | <i>Cement based grout injections in all cracks ;</i>  | Javed Construction       |        |        |        |        |        |        |        |        |        |        |        |
| c3       | <i>Stabilization of the stone masonry façade</i>      | Javed Constr.- MIEC Eng. |        |        |        |        |        |        |        |        |        |        |        |
| c4       | <i>Providing proper plinth protection</i>             | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |
| c5       | <i>RCC pillars at the corners of the building;</i>    | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |
| c6       | <i>Reconstruction of all corners and edges.</i>       | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |
| <b>d</b> | <b>Completion and finishing work.</b>                 |                          |        |        |        |        |        |        |        |        |        |        |        |
| d1       | <i>Flooring in marble and brick tiles;</i>            | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| d2       | <i>Wash terrazzo for masonry walls;</i>               | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| d3       | <i>Steel doors and windows;</i>                       | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| d4       | <i>Steel grilles for doors and windows;</i>           | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| d5       | <i>Aluminum frames, for glass doors and windows;</i>  | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| d6       | <i>Electrical system;</i>                             | MIEC Engineering         |        |        |        |        |        |        |        |        |        |        |        |
| d7       | <i>Plastering;</i>                                    | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |
| d8       | <i>Painting;</i>                                      | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |
| d9       | <i>False ceiling;</i>                                 | Fabricon Company         |        |        |        |        |        |        |        |        |        |        |        |
| d10      | <i>Stone cladding;</i>                                | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |
| d11      | <i>Carving of columns.</i>                            | Self-implemented         |        |        |        |        |        |        |        |        |        |        |        |



Block H: Selective demolition (photo by E. Loliva)

#### a. Selective demolition

The selective demolition of a part of the existing Museum building was carried out by “Javed Construction”, based in Mardan, a company specialized in controlled demolition and retrofitting.

A controlled demolition plan was designed to avoid any damage to the remaining part of the Museum building. It was recommended to follow all safety requirements against any possible casualties, e.g. fencing off the building, using hard hats, etc.

Step by step, the selective demolition was executed as follows:

- Removal of all valuables from the museum;
- Removal of excess materials from the roof top;
- Controlled demolition of the R.C. slab roof using cracking powder in order to avoid damages to the walls due to vibrations. Successively cement fragments were removed by hand.
- Removal of brick and stone masonry walls, row by row, starting from the top and finally uncovering the foundation of the demolished walls.

The structural design analysis of the existing Museum building provided by UET, was made mostly according to non-invasive analyses; consequently, only after the complete removal of plaster from all the walls, was possible to adapt the demolition process to the structure.



Block H: Selective demolition (photo by E. Loliva)



### 3. The New Swat Archaeological Museum



#### b. Foundation and Elevation structure

After a careful evaluation of the technical and financial aspects of every proposal, the “MIEC Engineering Services Company”, based in Nowshera, was chosen for its expertise and equipment to build the Steel, R.C.C. structure and masonry works. It was fundamental for the contractor to be equipped with a workshop furnished with reliable equipment in Nowshera where all steel components (pillars and beams) would be manufactured. Their execution was to be monitored in the workshop before moving them on the field and welded in their finished form, reducing mistakes in execution as well as the length of execution.

After the completion of the selective demolition in December 2011, MIEC was able to excavate the foundation. This phase was executed in conjunction with the steel elements for the primary steel structure that were built in the workshop.

As the foundation was completed, all the steel elements (pillars and beams), of the primary and secondary steel structure (for elevation and roof) were assembled and welded, and finally the reinforced masonry wall, which encased the steel pillars, was completed.

The quality of the construction, in terms of the execution and the materials used, were monitored daily on the field and tested in the laboratory<sup>8</sup>. Only materials in compliance with the structural drawings’ specifications were used.



Block A: elevation structure (photo by E. Loliva)



Block B: elevation structure (photo by E. Loliva)



### 3. The New Swat Archaeological Museum



Block A: Reception Hall and Veranda



Block B: Gallery 5 and 4







#### d. Completion of the finishing works

The finishing works were grouped in five clusters as follows.

1st cluster, tendered and awarded to MIEC, included:

- Flooring in marble and brick tiles;
- Wash terrazzo for masonry walls;
- Steel grilles glassed for doors and windows;
- Aluminum frames, for glass doors and windows;
- Electrical system;
- Steel anti-intrusion bars.

2nd cluster consisting of plastering and painting of external and external walls, were carried on by local workers according to the ACT self implementation phase.

3rd cluster consisting of stone cladding of internal and external walls, including the carving of columns, was implemented by specialized workers from Lahore and Taxila, according to the ACT self implementation phase.

4th cluster consisting of the false ceiling was tendered and awarded to “Fabricon Company”, from Karachi.

5th cluster consisting of furniture (in cement blocks cladded with decorated cement tiles) and showcases (in steel and glass), tendered and awarded to MIEC.

#### *Finishing works and Materials*

##### – Stone cladding and marble flooring

Steel structures are extraneous to the local culture, therefore in the finishing work, local materials were used in order to create a direct rapport with surrounding cultural contexts.

All of North Pakistan is famous for its stone and marble quarries<sup>9</sup>. This sector is not as advanced as it could be considering that its materials are of high quality.





The golden stone utilized in the Wall claddings, and the grey limestone utilized in the side galleries cladding, come from quarries in the Malakand region. The golden stone is irregular in color with red or yellow veins, and it was utilized in three rectangular forms, placed in three rows uneven in height that run along the slanted Wall. The grey limestone, utilized in the side galleries cladding, is homogeneous in color and of one rectangular size only, placed in a regular pattern.

Even if an effort was made to employ local workers for the finishing work, it was impossible to find local workers for specialized work, like stone work, even if some times ago they were easily obtained. On the other hand in the larger cities of Pakistan, Lahore and Islamabad, these types of specialized work are becoming quite diffused, particularly in private houses of the new Pakistani middle class. New materials and technologies are being introduced in the market, most often from neighboring China.

For these reasons expert workers from The Punjab region were employed to do the specialized stonework. In particular, the Gandharic stone facing of the portal was given to an artisan from Taxila, where dozens of workshops flourish. The execution of this process, monitored by ACT technician Roberto Dentici, and executed with simple hand tools, was rather lengthy given the difficulties in reproducing with regularity and without interpretations the same geometrical design. In order to simplify the process, the drawings were placed directly on the stones and then sculpted. Specialized teams from Mingora and







Lahore were employed to work on the anchoring of the cladding stones.

The two Gandharan columns, placed under the portal, were sculpted directly in situ from two blocks of light grey stone, and every column is formed by five properly anchored parts.

The cladding of the internal walls, the slanted walls inside the courtyards and in the showcases were realized in *wash terrazzo*: a conglomerate of white cement and small marble stones, laid, brushed and painted by hand. In particular the carved rock art figures on the slated walls have been realized by artist Murad from Saidu Sharif.

Facing cement tiles with the same Gandharan decorative pattern chosen for the portal were used to underline the opening of the courtyards, the furniture and the pillars in the reception halls and galleries. Frames in aluminum were used for the tiles, and the pouring of white cement and crushed marble was done in situ.

Three types of marble were used for the inside floors of the Museum: green marble for the reception hall, and the first courtyard; fish white marble for the lateral sides of all the galleries; and golden marble for the main Gandharan Gallery. A light grey stone was used in the entrance hall.

A mosaic was placed in the central corridor that connects all the galleries, made of white cement and golden green and yellow marble rubble, like an homogeneous uninterrupted carpet. The edges of the corridor are defined by a strip of golden marble. This choice has the effect to confer a great luminosity to the internal spaces. The floors of the second courtyard and of the plinth protection are in brick tiles. The floors' execution process consisted of laying, grinding, brushing and polishing.





#### – False Ceiling

The plasterboard false ceiling consisting of adjacent plasterboard panels provides a visual continuity in the halls, and hides the metal structure of the roof. This technology, based on the use of plasterboard panels held up by a structure in light steel gauge, is little used in Swat, even if it is widely used in big cities like Lahore, Islamabad and Karachi, where one can find specialized firms that can install them. Thanks to simple and fast methods of execution, this technology has taken a widespread hold in the country, particularly after the 2005 earthquake, and the diffusion of prefabricated elements in public buildings. Its materials are mostly imported from China and Malaysia.

In all museum's spaces the light steel gauge structure is directly joined to the roof structure, but not joined to the walls, allowing both a view of the primary steel beams of the roof and an air flow under the roof, thus defining the lateral spaces of the exhibit halls.

#### – Doorways and Windows' Anti-intrusion Systems

Even if Swat is justly famous for its traditional artisan production of wood doors, windows and furniture, using wood was strongly discouraged due to the presence of termites that in years past had caused rapid damages. Since a constant upkeep of the edifice was not a realistic option, a choice was made in favor of using aluminum and glass windows while the doors in the emergency exits and the main entrances had been realized in steel and glass.

All the doorways and windows have been designed to be elements of decor and beauty in the Museum; they are not visual barriers but they allow the light to shine through the steel grilles and the glass, fusing, so to speak, the internal and external spaces.

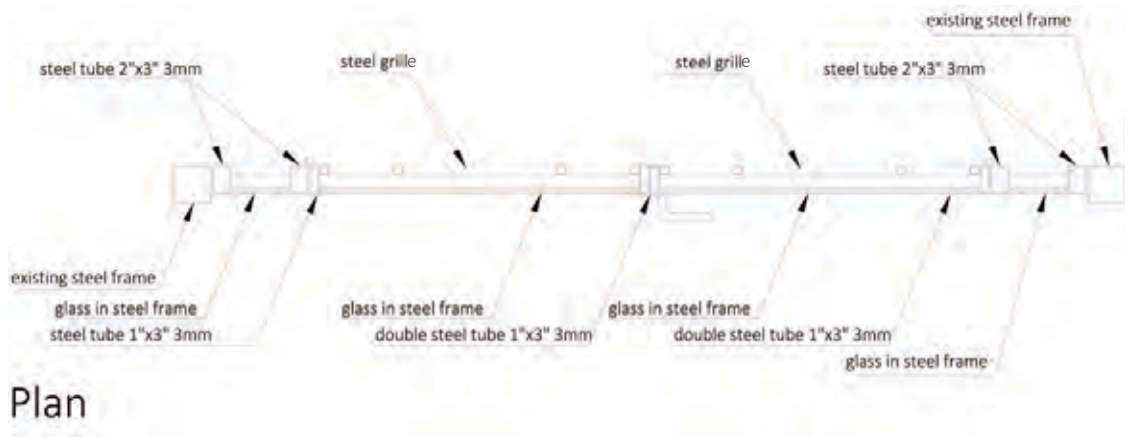
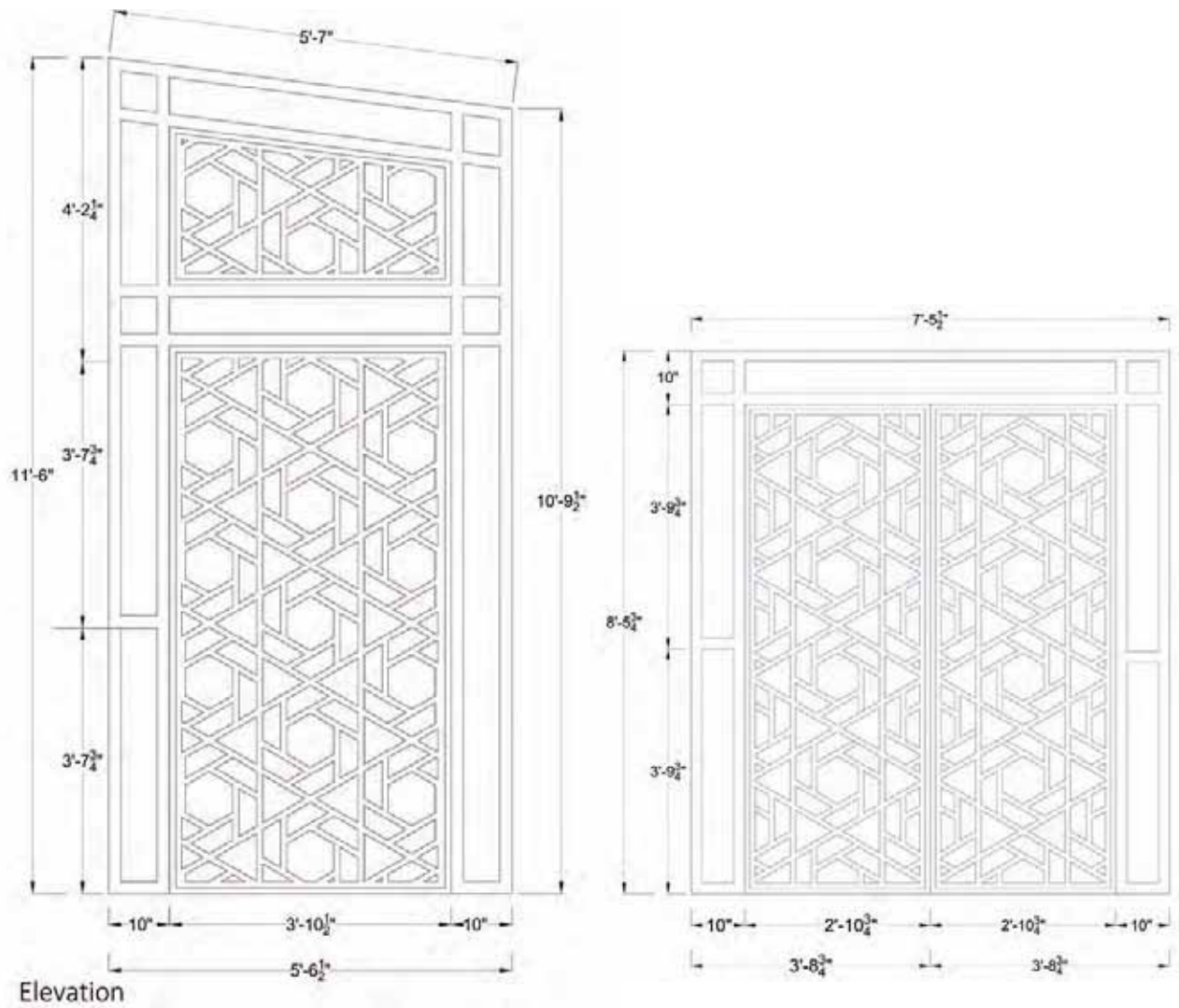
Another important consideration was to defend the museum from possible intrusions. Several passive barriers were introduced:

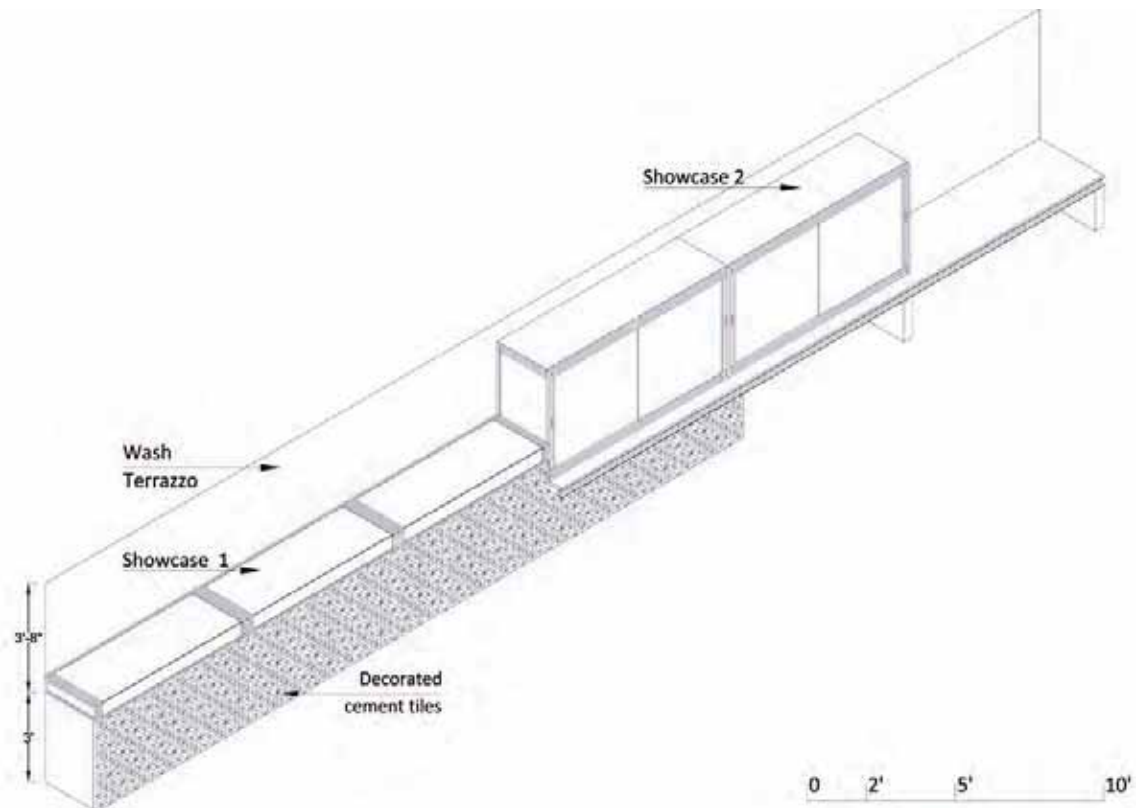
- Steel grilles in every window;
- Steel grilles doors in all entrances and exits of the galleries, to divide the halls in sections thus reducing danger of intrusions;
- Steel bar barriers were placed over the four lowest spaces in the emergency exits points.

The steel grilles in all the openings, doors and windows were realized with the same Islamic pattern used in the main entrance, and adapted to the various dimensions.









– Interior design: furniture and illumination

The interior design, including furniture and illumination, was conceived and realized in order to enhance the exhibit potential of each gallery, keeping in mind the typology, size, and material of the displayed artifacts.

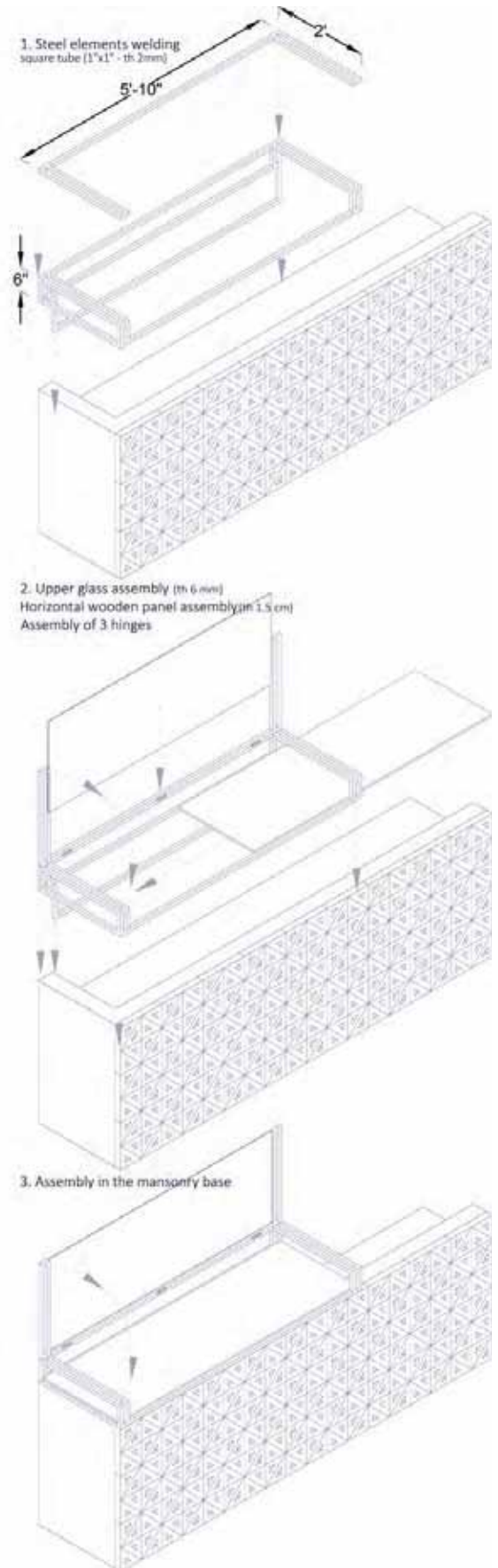
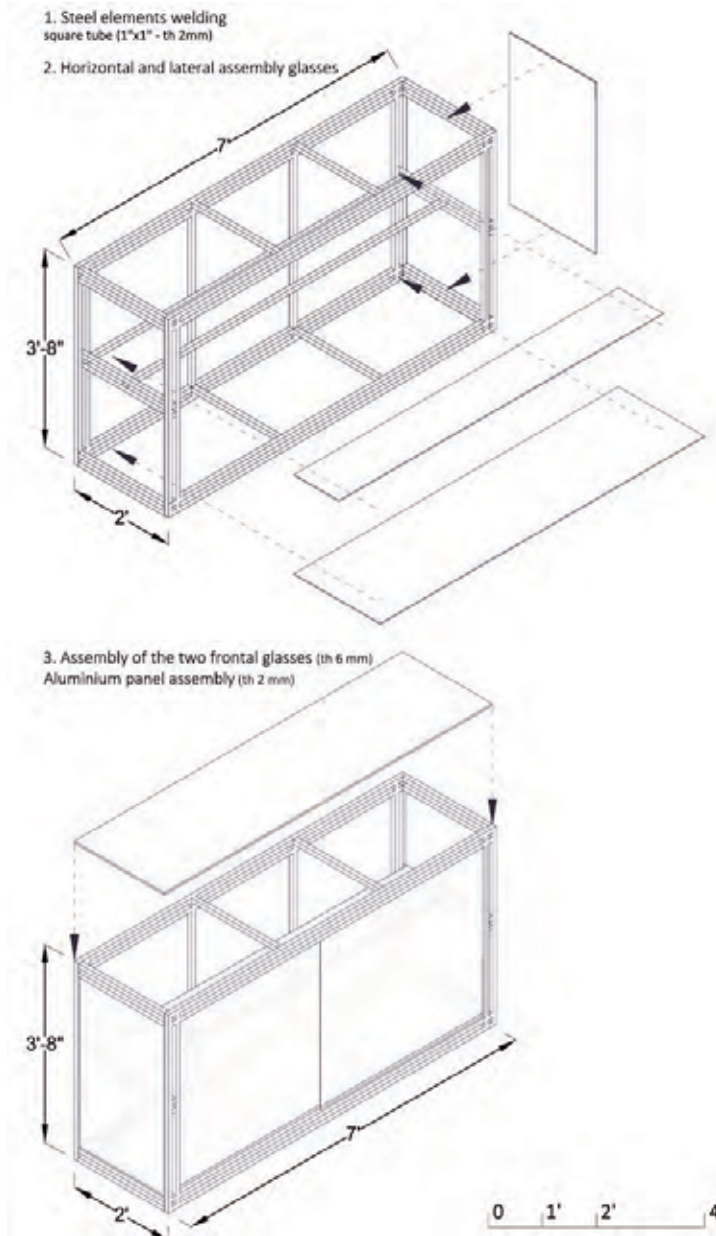
The furnitures were assembled in two parts: one, fixed in masonry clad with cement tiles decorated in Gandharan pattern, and the other, movable, in modular showcases (with illumination steel encasings, and topped by glass) easily adaptable to accommodate the different sizes of the artifacts.

The illumination system in the galleries presented several problems. A limited budget did not allow a sophisticated illumination system; in any case, the chronic lack of reliable electricity for the best part of each day would have made useless a costly investment. It was necessary, furthermore, to leave with the DOAM a simple upkeep of the light fixtures, and an inexpensive and readily available supply of change parts. For these reasons the light system was kept as simple as possible, counting on natural light as a primary source of illumination.

Illumination is indeed simple: the lighting system in the entrance veranda consists of four energy saver light bulbs. In the reception hall, a light steel structure was built, in the form of a half hexagon, that recalls the Islamic pattern of the steel grilles, welded to the grille in the entrance veranda and suspended from the roof structure. A similar structure was placed in every exhibit gal-



### 3. The New Swat Archaeological Museum



lery (but not in the H block). The structure confers a visual continuity element and guide the visitor's attention.

The structure is placed parallel to the floor at a height of (8'-6"), and repeats the golden stone frame of the mosaic on the floor. The structures house lead track lights pointed to the exhibit cases and at the free standing sculptures placed in the halls, while energy saver light bulbs are fixed directly in the false ceiling for the gallery's main illumination. Horizontal light tubes were placed inside masonry furniture and in the metal exhibit showcases, on their longest sides, where the light is diffused by glass placed at the bottom and in the central partition of the showcases.





Main Elevation



Side Elevation



From the main road





#### – Entrance/Exit Space

This Entrance/Exit space could be considered a traditional “veranda”, because it is a covered external space from which the exhibition pathway begins and ends, by two doors situated on the lateral sides. This space presents, on the front, a portal supported by two columns, and it is closed at the back with a steel grille in an Islamic pattern.

The Museum, with its antiquities, is always placed in the foreground; the entrance is located on lateral sides, because the visitors are introduced to the exhibits as spectators rather than protagonists.





First Courtyard





### 3. The New Swat Archaeological Museum



Second Courtyard

#### – Courtyards and natural light

The two courtyards are located between the existing block and the two new blocks, and they correspond to a fundamental space for the local culture and it is a “safe” place for reflection and social interaction.

The exhibits continue on the slanted Wall in these spaces, so that the carved rock art figures become a part of the whole exhibit.

The doorways to the courtyards allow the natural light to enter inside and to illuminate indirectly the galleries. This aspect is essential considering the almost daily electricity shortages. The use of a natural light consents to experience the building in a spatial and temporal dynamism, where the light and shape mark the flow of time, as a metaphor of day and night.





### – Reception Hall

A wide Reception Hall was designed to welcome a large numbers of researchers, students and visitors. From the Reception Hall, the clockwise pathway exhibition starts on the left side, and stops on the right side. This monumental hall interacts with the entry space and with the first courtyard through steel grilles creating a visual continuity between the external and internal spaces. Consequently, the natural light is predominant and it is used as an architectural element to give depth and indirect light. The reception desk, used for tickets and information, is located in the middle, and faces to the back of the Entry/Exit space and in front of the courtyard.



### 3. The New Swat Archaeological Museum

#### – Galleries

The exhibits are meant to be viewed following a clock-wise direction, beginning and ending in the reception hall and going through the two courtyards. The exhibits recount the history of Swat, from its early beginning in 1400 BCE until the present day, in the 21st century CE, including the unique and rich Gandharan collection.



Gallery 3



Gallery 4



Gallery 5

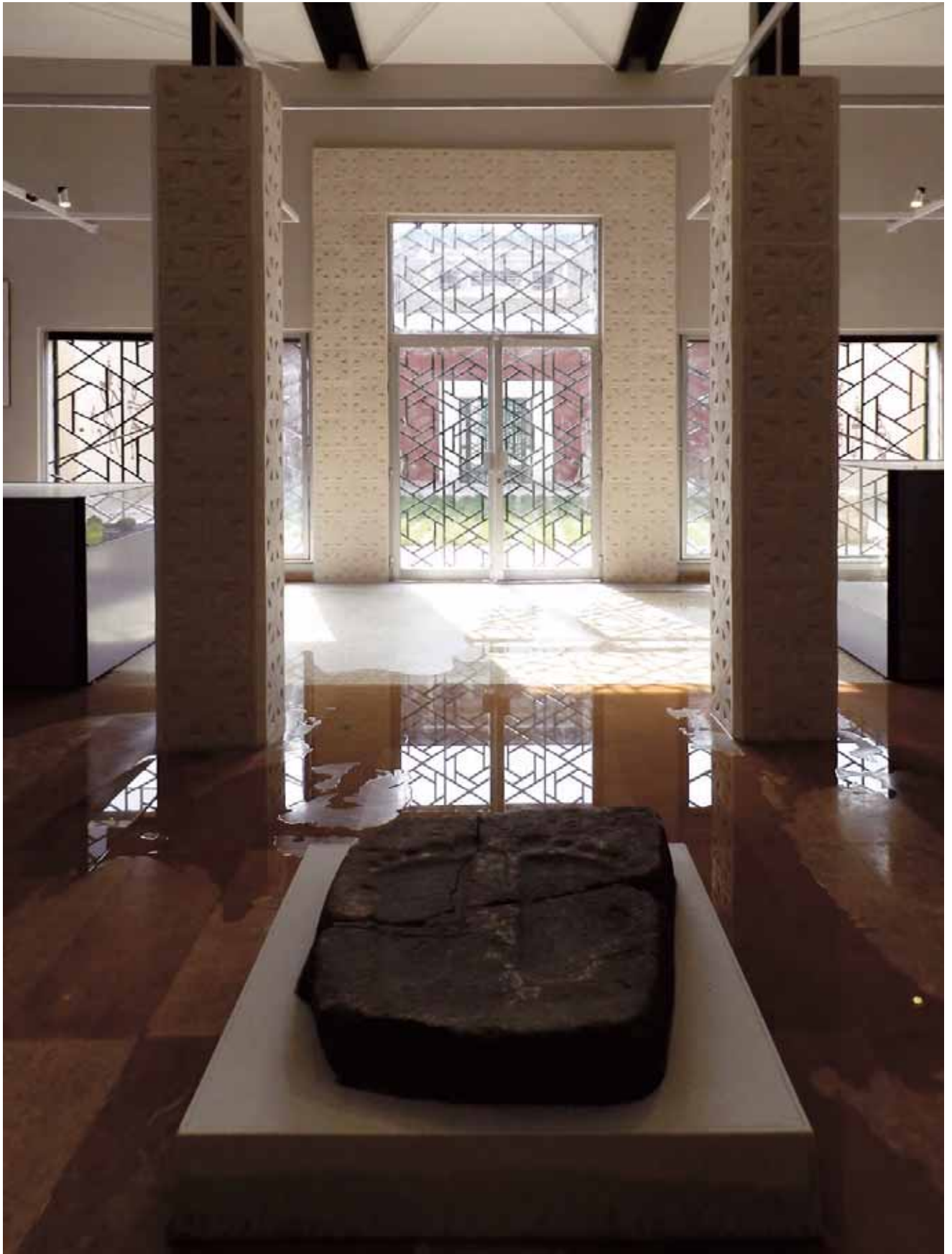


Gallery 5



Gallery 5









Gallery 6



Gallery 8



Gallery 9



– **Emergency Exit Nodules**

The emergency exit nodules consist of four passages located between the existing block H and the two new A and B blocks. The galleries are connected to the courtyards and to the exterior of the building by four doors situated on each side of the exit nodules. These doors can be opened or closed according to need, allowing for the independent use of the conference hall, the isolation of each gallery for security reason and the access to the emergency exits.

Structurally, the nodules are completely separate by the central block and they can be considered as expansion joints. In elevation, because their height is lower than the other blocks, they mark the passage between two different volumes of the existing and new constructions.



## NOTES

1. Row of square panels with axes, bisected into triangles each containing an indented triangle (Faccenna and Filigenzi 2007: 106, Pl. 67.4, fn. 4).
2. The Islamic pattern was designed using a model taken from the Museum of Islamic Art in Doha, Qatar made by arch. I.M. Pei. The decorative pattern can be found in several examples of Islamic architecture.
3. The six-pointed star in Islamic culture represents in the microcosm the six possibilities of motion in the six directions: north, south, east, west, nadir, zenith (Mandel, 2007: 8).
4. The earthquake, in October 2005, with a magnitude of 7.6 on the Richter scale, caused more than 70,000 casualties; the vast majority of people were trapped under collapsed homes, schools, and hospitals. Entire towns and villages were completely wiped away in Northern Pakistan.
5. The UET Consultancy Cell, after technical advise requested by ACT, proposed a R.C. slab on top of C.G.I. sheet realizing the roof with steel net and concrete cement. Effect of the proposed change, on the design of building, was also investigated. After incorporating, the proposed change in the analysis model, the design was found in compliance with code requirements.
6. SAP2000, CSI (Computers and Structures Inc.). *SAP2000 Advanced 12.0.0 Integrated Finite Element Analysis and Design of Structures*. CSI, Berkeley, 2008.
7. After the completion and approval by DOAM of the preliminary architectural and structural Drawings in August 2011, a pre-selection research began through advertisement in newspapers in order to identify appropriate construction companies and invite them to compete for the project's tenders. A number of Companies were prequalified for the execution of the construction, on the basis of the project requirements, and their experience.
8. Samples were taken from the mixed concrete, from the R.C.C. steel reinforcement, and the cement blocks, and were tested in the laboratory. Cylinder samples from the concrete mixture were taken from time to time and tested in compression after 28 days. Reinforcement steel, used for R.C.C., was checked for its size and quality by testing samples collected from the site. In addition, proper wooden formwork and vibrators were used to insure the quality of concrete mixture for R.C.C..
9. Before transporting them to their location, all the structural steel elements were checked for their quality, sizes, welding etc. in the workshop, and also the entire execution of the fixing and assembling was checked in the construction site.
10. Acquiring local stone and marble for the Museum's project was difficult because of the unreliable availability of consistently high quality materials of sufficient quantity. Mining and processing technologies are yet to be automated. Quarries are often still owned by landowners, who are not interested in upgrading machineries and techniques. Stones are mined with explosives. Most of the stone and marble used in the Museum came from Malakand Division. Quite often the military forbid the use of explosives shutting down the quarry. In January and in February 2013 the quarries where white fish marble (used in the galleries' floors) and the grey stone (used for cladding the walls of the lateral blocks) were mined, were both closed down for security reasons. As a result ACT and MIEC (Contractor) were unable to find stones of an equivalent quality to the ones already used in parts of the Museum. It became necessary to find similar stones from a different quarry.



## APPENDIX

### Swat Museum: A Visual Cultural Path\*

*Edited by Luca M. Olivieri*



#### MUSEUM GALLERY 1

##### THE SWAT VALLEY

Swat, or Uddiyana as it is called in the Sanskrit sources, is a valley in the mountainous region to the north of the Peshawar Plain, at the foot of the mountain range connecting the Hindu Kush with Karakorum: it includes the main valley of the upper course of the River Swat, for a length of about 200 km from the source as far as the gullies through which the river flows down to the plain, and the lateral valleys of its tributaries.

The valley, conquered by Alexander the Great in 327 B.C., and over the following centuries by the Indo-Greek, Saka, Parthian, Kushan, Sasanian and Hephthalite kings, was a prosperous region. It constituted a trading centre between the plains of Gandhara and the mountains of the northern areas looking towards Central Asia, and at the same time a great centre of Buddhist culture with an ample scattering of Buddhist monasteries, representing an important stopover on the way to the holy places of Buddhism, traversed by numerous Chinese pilgrims (including Faxian in the 5th century CE, Songyun in the 6th, Xuanzang in the 7th and Huizhao in the 8th). By virtue of its position open to the Iranian world, Swat was always characterised by the powerful influence that the local – Dardic – substratum exercised over Buddhism, to the extent that it became a centre for the formulation and dissemination of esoteric doctrines merging into the “Diamond Vehicle” (Vajrayana) tradition. As commercial traffic increased between the Tarim basin, in modern-day Chinese Xinjiang, and the Indian ports through Karakorum, Swat found itself at the point where these routes issued into the plain of Gandhara, thus becoming a place of transit not only for goods but also ideas – a role it maintained even after the economic decline that marked the late 6th and early 7th century CE. It was in fact from here that Padmasambhava, the moving force of Tibetan Buddhism, set out in the 8th century, and it was indeed the accounts of this “holy land” of Buddhism contained in the Tibetan texts that brought Giuseppe Tucci here in 1955.

\*Text elaborated after Callieri et al. 2006;  
Illustrations: Courtesy of the Italian Archaeological Mission/IsIAO Centro Scavi; ACT Project; Miangul Family Archives. The photos of Nimogram are by J. Raducha (Courtesy: <http://uwdc.library.wisc.edu/collections/Arts/Nimogram>)



#### THE YUSUFZAI STATE OF SWAT AND ARCHAEOLOGY

Archaeological researches in Swat began with a survey conducted by the great Hungarian-British explorer and archaeologist Sir Aurel Stein in 1926, when the bellicose Yusufzai tribes of the region that had never allowed themselves to be “tamed” by the British Empire and opposed any western presence were pacified by the creation of a unitary independent state governed by an enlightened ruler, Miangul Badshah Saheb (left). The survey conducted by Stein was followed in 1938 by a hasty reconnaissance campaign with non-scientific excavations carried out by Ph. Barger and E. Wright on behalf of the Archaeological Survey of India.

Both surveys were supported by the Badshah who, already in 1938, conceived the idea of an archaeological Museum in Swat.



The first systematic scientific excavation work was carried out by the IsMEO Italian Mission. The activity of the Italian Mission was possible thanks to the support of the last Wali of Swat, Maj. Gen. Miangul Jahanzeb (right). In those years the Ancient Monument Protection Act (then Antiquity Act 1975) was introduced in Swat. In 1958 the first Swat Museum was created with the financial and logistic support of the State, and the scientific contribution of the Mission, within the legal framework of the Pakistani Department of Archaeology. The Museum was then expanded in 1963, and again in 1969 to house the increasing number of objects recovered by the different research teams.

In fact, besides the Italian Mission, seminal research were carried out by the Department of Archaeology and Museums, Government of Pakistan (such as the excavations at Nimogram led by M. Rafique Mughal, Inayat-ur-Rahman and M. Nazir Khan, and the dig at Gumbatuna, led by M. Ashraf Khan), by the Department of Archaeology of the University of Peshawar (such as the excavations at Butkara III and Shnesha, led by Abdur Rahman, and at Marjanai, led by Shah Nazar Khan).

#### EARLY HUMAN PRESENCE



Archaeological research has stressed the importance of Prehistory and Proto-history for the reconstruction of the chronological and cultural sequence of human presence in the Swat Valley. The excavations of the Ghalegay rock-shelter, carried out from 1967 onwards, yielded the first highly important results: by correlating the graveyards’ remains with those found in the shelter. Archaeologists were able to determine a complete sequence from the late Neolithic to the Iron Age (3rd-1st millennium BCE).

On the basis of the earlier layers of the Ghalegay rock-shelter, the first occupation of the Swat Valley was ascribed to late Neolithic period. However, the oldest evidence of human presence goes back to Palaeolithic Age after the discoveries of some stone tools such as two bifacials, several pebble tools and other prepared flakes during survey campaigns in the Kandak area (Middle Swat). These findings without doubt represent new and very important evidence regarding prehistoric research in Swat and also Pakistan, because they indicate that the low and medium altitudes of the mountain regions did not represent a

barrier to our ancestors of the Pleistocene. Nevertheless, such evidence must be supported by new research in which the archaeological data are fleshed out by reliable palaeoenvironmental data.

If we observe the western regions of the Karakorum-Himalaya, we cannot miss the similarity between the Middle Swat and the Kashmir Valley. Both actually possess geographic characteristics that make them similar to each other, such as altitude, climate and environment, and both present the same prehistoric evidence. Therefore, the finding of Palaeolithic remains in the two areas is not a coincidence, but it must be related to the, albeit occasional, human occupation of these territories during the improved climate periods of the Pleistocene.

## MUSEUM GALLERY 2

### PROTOHISTORY OF SWAT: PROTO-URBAN PHASES (1400 BCE) AND GRAVEYARDS (1200-500 BCE)

The discovery of some graves dating earlier than the Buddhist age in the early 60s suggested extending archaeological research in Swat Valley to the Proto-historic period. Later research carried out in several necropolises such as Kate-lai, Butkara II, Loebanr I and other minor sites allowed to establish their precise chronological setting between Late Bronze Age and Iron Age. On the basis of the excavated data, it has been possible to attribute the graves to three cultural periods: early (14th-11th century BCE), middle (10th-8th century BCE) and late (7th-4th century BCE). Several funerary customs appear to have been practised at the same time during these three phases: cremation, inhumation and disarticulated inhumation. Graves of the later period were brought to light also in the adjacent regions of Chitral, Buner and Indus Kohistan, while other important cemeteries were excavated in Dir and Peshawar plain.

However, it was above all the excavations in the vast site of Aligrama that cast light on the late Bronze Age. The site, already inhabited in the 18th century BCE, yielded important evidence of later phases (1400-800 BCE), including traces of a ploughed-field showing parallel furrows and a large rectangular hall interpreted as a sacred building.

Research from the late 70s onwards has focused on the Bronze Age (1700-1400 BCE). The investigations at Barikot, Loebanr III and Kalako-dherai have in fact brought to light remains of villages formed initially by huts partly dug into the ground, and subsequently by stone masonry on square or rectangular plan. According to the collected data, more prosperous agriculture and better environmental conditions could explain a probable demographic growth and the foundation of these settlements. Furthermore, the inclusion in a commercial network connecting the Swat Valley with the Indus plain as well as with Kashmir and trans-Himalayan territories allowed an economic development







during this period. Painted pottery bearing decorative motifs which reveal clear affinity with the post Indus Valley phase, and in particular with the so-called Cemetery H Culture at Harappa, form a good clue of these links. The sites of Aligrama and Barikot were abandoned quite abruptly, and this fact marks the end of the Protohistoric settlements in the second half of 1st millennium BCE.

#### RECENT EXCAVATIONS AT UDEGRAM G AND GOGDARA 4 (2012)

The Protohistoric graveyards have recently been the objects of renewed scrutiny. The fundamental problem left over was the one linked to the reconstruction of the funerary monuments as well as the funerary rituals. The old digs' results did not offer elements for the reconstruction of graves, i.e. as they would have appeared when they were in use.

The recent excavations in the small necropolis of Gogdara 4 (left) and in the larger one of Udegram (right) have allowed the archaeologists to reconstruct, thanks to micro-stratigraphy, the surfaces in use around the graves, their phases of reopening, and the phases of abandon. The tombs were dug in artificial terraces and used over and over again. In one of their phases evidently a wood fence enclosed the tombs, and eventually an earthen mound covered them. The funerary sequence included the exposure of the corpse, the cremation of the bones, and finally its burial. In this final phase, sometimes a second corpse (almost certainly female) was added to four tombs at Udegram. The preliminary C14 results have given us a dating far older than expected (end of the 2nd millennium BCE), while the presence of an iron artefact could result to be the oldest artefact ever found in the Indo-Pakistani subcontinent.



#### EARLY AGRICULTURE OF THE SWAT VALLEY (3rd-2nd MILLENNIA BCE)

Evidences of the proto-historical agriculture from the archaeological deposits in Swat document different stages of a unique local agricultural phenomenon, since the beginning of the 3rd millennium BCE.

For example at Aligrama was documented a palaeo-soil with traces of ploughing dating back to 2nd millennium BCE (right).

Wheat (*Triticum aestivum* and *Triticum sphaerococcum*), barley (*Hordeum vulgare*, *Hordeum distichum*) and rice (*Oryza sativa* var. *indica*) were the most important grain crops of the region. The finding of rice glume imprints and phytoliths in potsherds, from the bottom of the archaeological deposit of the rock shelter of Ghalegay, testified the early cultivation of rice in the region. The impressions represent the oldest evidence of the rice cultivation along the Indus Valley, dating back to the first half of the 3rd millennium BCE.

The agricultural economy also included the cultivation of legumes, lablab peas (*Dolichos lablab*), lentils (*Lens culinaris*) and peas (*Pisum* sp.), and a local variety

#### The main crops



Rice



Wheat



Barley

#### Additional crops



Lentils



Flax



Grapevine



of grapevine (*Vitis vinifera*). The exploitation of flax (*Linum usitatissimum*), as possible source of fibers and oil, and the use of local wild fruits was documented by the presence of charred seeds and of a great number of fruit stones of hackberry (*Celtis* sp.). Seeds of common weeds and pest plants (*Aegilops*, *Argemone*, *Euphorbia*, *Galium*, *Lithospermum*) gave us information on the ecology of the cultivated fields.

The contemporary presence of the two most important cereals suggests that a kind of rice-wheat cropping system was the base of the food production. The two crops could grown in sequence in the same year: This rice-wheat system could include additional crops (legumes) to produce diverse foods and avert risk of food shortage. The by-products could be harvested and used as fodder and bedding for livestock, as fuel for cooking, as well as roofing and fencing.

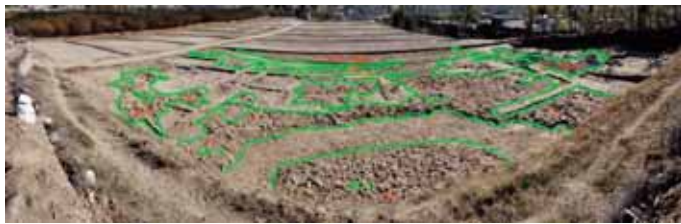
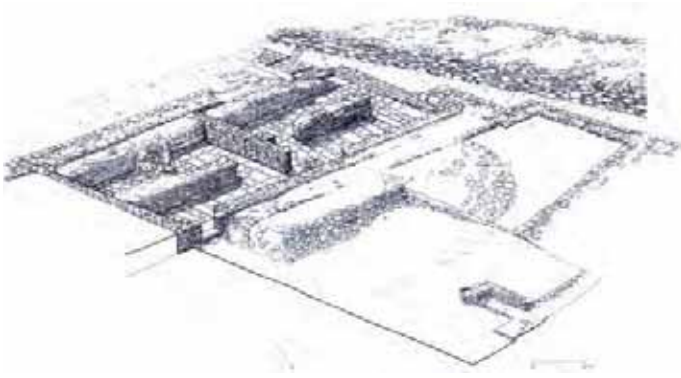
### THE PROTOHISTORIC ROCK PAINTINGS (1400-400 BCE)

Painted shelters are usually large gneiss boulders metamorphosed and eroded by glacier action located in rugged and hard to access places, but clearly visible at a great distance. The interior, or protected space, may barely have been sufficient to shelter more than 1-3 persons at the same time. The figures are painted in dark red ochre, the more recent in orange ochre, and more rarely in white or yellow. The shelters deemed to be the most ancient, those of Sargahsar 1 (left) and Kakai-kandao (right), display highly symbolic compositions, the syntax of which is based on associations, oppositions and combinations of iconographic themes.

In the older painted shelters the horse is absent and agriculture is emphasized, in the later examples warriors are constantly associated with horse-riding. The horse icon was possibly the totem of the Assakenoi, or at least their eponymous animal: these are the peoples that Alexander encountered in Swat at the end of the 4th BCE. The theme of the hero carrying a shield associated with the ibex and the large feline is a recurrent one in rock art from the Bronze Age. In summary, we are dealing with an early phase datable to the Bronze Age (before 1400 BCE), when paintings possibly represented agricultural rituals and wild animals, perhaps depicting specific divinities; in this phase the hero appeared for the first time, holding a shield. In the long transition phase towards the Iron Age (1400-400 BCE), with the well-known extensive graveyards, warrior and pastoral figures predominate, but above all the depiction of the horse.







### MUSEUM GALLERY 3

#### THE URBAN SITE OF BARIKOT: 3000 YEARS OF CONTINUITY (1400 BCE-1400 CE)

Over the last 30 years the main object of research has been the built-up areas of the Pre-Islamic period, with excavations in the centre of Barikot (Bir-kot-ghwandai), necessary now in the face of the urgent need to provide the relevant institutions with indications for permanent protection of the site, exposed to the risk of being wiped out by expansion of the nearby urban area.

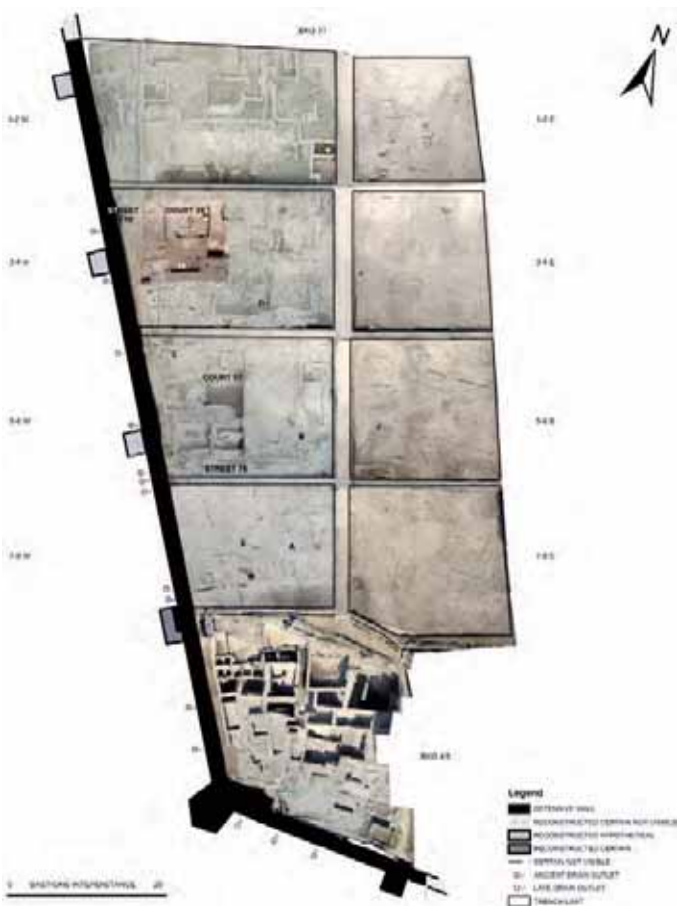
The excavations were initially carried out between 1984 and 2006, including a 2-year campaign of topographic survey of the entire hill and plain area. The research conducted so far, have confirmed the importance of the historical period site identified by Sir Aurel Stein and Giuseppe Tucci as the ancient city of Bazira mentioned by the historians of Alexander the Great, conquered by him in 327 BCE.

The city – overlooking the skyline of Mt. Ilam - is mentioned as Vajirasthana in a 9th century CE Sarada inscription acquired in Barikot, now at the Lahore Museum.

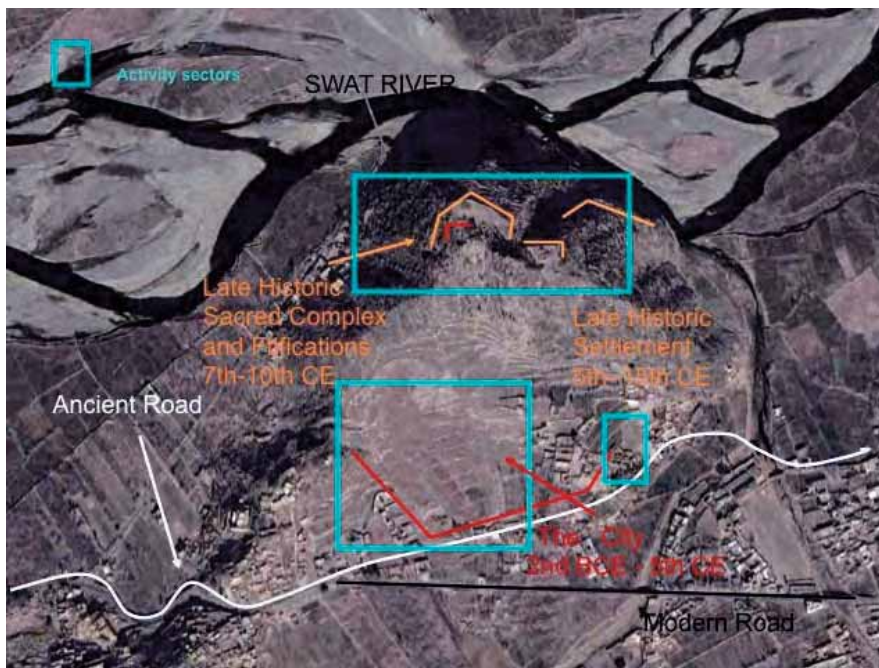
In 2011 the excavation was expanded and it is now covering an area of approx. 10,000 sqm. (Trench BKG 11, below, left) in the southwestern quarters of the ancient city.

#### THE URBAN SITE OF BARIKOT: THE FORTIFIED CITY (2nd CENTURY CE-4th CENTURY CE)

Besides the rich stratigraphic sequences in 7 different parts of the built-up area, spanning from the 2nd century BCE to the 4th-5th century CE to continue in the area on the hill and hillside to the Proto-Islamic period (13th-14th century CE), also well preserved architectural remains







have been identified. Among these, we may mention, in the flat land, stretches of the southern and western sides of the historical period city wall (2nd century BCE) and, within, a settlement area including two dwelling units (3rd-4th century CE.) and a small Buddhist cult area (late 2nd-3rd century CE). The material found illustrates all the artisan productions characteristic of the life of a settlement, but it is, of course, the pottery that accounts for most of it and holds the greatest interest, since publication of this material, now under way, will in fact provide that standard sequence for the material culture of the historical period still wanting in the archaeology of region.

#### THE URBAN SITE OF BARIKOT: THE INDO-GREEK DEFENSIVE WALL

The Macedonian control on the garrison of Bazira lasted from Autumn 327 BCE to 326 BCE, when the hipparch (Commander) Nicanor withdrew from the Swat area after a rebellion of the native troops ended up with the assassination of Siscottus, who was in charge of the military region of Aornos (Mt. Ilam).

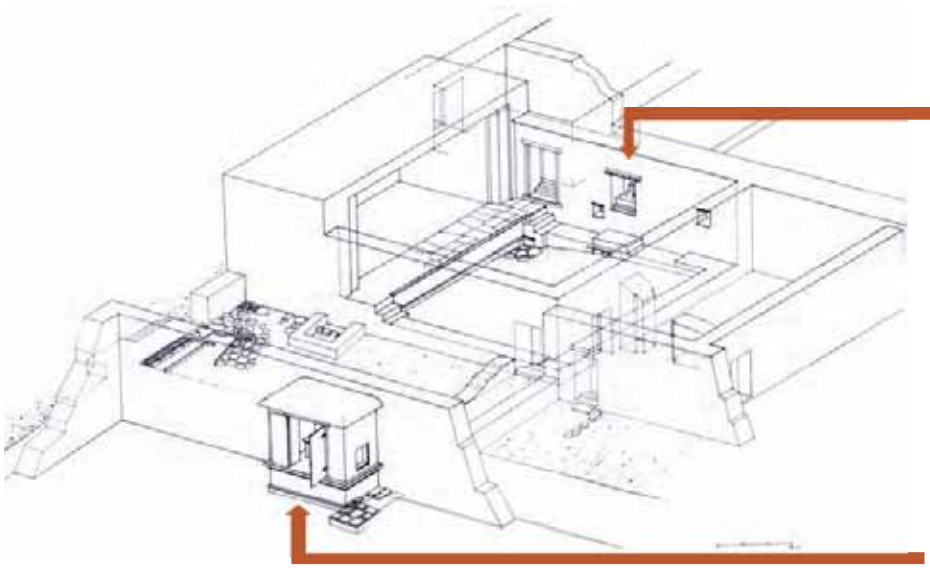
With the arrival of Greek invaders from Bactria (NE Afghanistan), the Swat Valley fell under the rule of a new dynasty: the Indo-Greek. Under the rule of Zoilos I (end-2nd century BCE = Period III) Bazira was re-fortified. The new city wall is provided with rectangular bastions and pentagonal corner bastions. The inter-distance between the bastions is equivalent to 100 Attic feet (= ca. 28 m = 1 *plechtron*), while the width of the wall corresponds to 10 Attic feet (= ca. 2.8 m).

The defensive wall was abandoned in Kushan times (early-2nd century CE = Period VI), when the city, was demilitarized (*pax kusanica*).

The city wall is fully preserved in the SW quarters of the ancient city for 150 m along the W stretch (above, left), and for 30 m along the S stretch (Trench BKG 4-5). The original length of the S stretch was ca. 500 m. The city wall encompasses an area of ca. 4 hectares (lower city); the entire city extension, including the acropolis, covered ca. 12 hectares.

Portions of the S stretch were documents in various trenches. The positions of the SE corner of the city wall, as well of the gate, have not been determined so far.

Portions of the city wall in the Trenches BKG 4-5 and 11 have been recently restored.



#### THE URBAN SITE OF BARIKOT: LATE-KUSHAN BUDDHIST SACRED PRECINCTS



In the Trench BKG 11 two Buddhist sacred precincts were documented: BKG 13-28 (above) and 107-108 (below). Originally constructed in Late-Kushan time (3rd century CE = Period VII), they were rebuilt after a major earthquake during the rule of the Sasanian Kushanshah Peroz I (end-3rd century CE = Period VIII).

After a second destructive earthquake the urban quarters of the Trench BKG 11 were abandoned.

During the first half of the 4th century (= Period IX), the ruined quarters were briefly occupied by non-urban settlers.

#### MUSEUM GALLERY 4

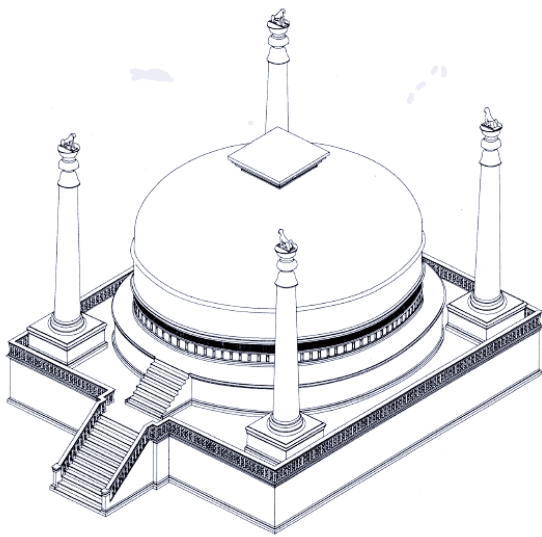
##### GANDHARAN ART AND ARCHITECTURE: THE SACRED AREA OF SAIDU SHARIF I (1st-4th CENTURIES CE)



The sacred area of Saidu Sharif I – the only one of the three excavated complete with monastery – developed in a far more limited span of time (1st-4th centuries CE), but nevertheless afforded the opportunity to study a monastic complex in its entirety.

In the field of monastery residential structures, certain details regarding the construction of the monastery of Saidu Sharif I have proved extremely interesting from the architectural point of view. A flight of steps gives access to





the monastery, in two ramps converging at the centre. The monastery was supported by a system of substructions on the western side of the building, with concamerations covered by false ceilings. These features mark this complex out from the models to be seen in the plain of Gandhara.

#### GANDHARAN ART AND ARCHITECTURE: THE SACRED AREA OF SAIDU SHARIF I (1st-4th CENTURIES CE)

With excavation of the sacred monuments of the Buddhist sanctuaries of Butkara I, Panr I and Saidu Sharif I, on the one hand, and, on the other hand, study of the numerous monuments in a state of ruin still visible in the valley, each with its own characteristics, it has been possible to glean a very considerable quantity of data on the construction techniques and structures of the monuments. New horizons have opened up, for example, in our knowledge of the upper part of the great *stupas*, and we now have a clearer picture of the "dome" (*anda*) with the series of discs, supports, spacers between one disc and another and the structure of the discs consisting of a number of elements assembled together. Moreover, we have gained a fuller knowledge of certain classes of monuments including the isolated column (*stambha*), the pillar, the chapel (*vihara*) and the pseudo-*vihara*, the latter monument being on a square base with a square body with roofed corridor, and "dome".







## MUSEUM GALLERY 5

### GANDHARAN ART AND ARCHITECTURE: THE SACRED AREA OF BUTKARA I (3rd CENTURY BCE-11th CENTURY CE)

Thanks to the stratigraphic investigation methodology, it has been possible to trace out a reliable picture of the typological evolution of the monuments themselves and the planimetric organisation.

From this point of view, the sacred area of Butkara I, and in particular the Great Stupa with its five reconstructions over the entire lifespan of the complex (3rd BCE – 11th CE), has represented a fundamental stage: in fact, with study of the structural connections of the pavements and of the various phases in the life of the Great Stupa it has been possible to associate the individual minor monuments of the sacred area with the phases of the Great Stupa, thus providing the groundwork to trace out a complete picture of the evolution not only of the typologies, but also of the architectural decoration.



### GANDHARAN ART AND ARCHITECTURE:

### THE SACRED AREA OF BUTKARA I (3rd CENTURY BCE-11th CENTURY CE)

The data from Butkara I constitute a fundamental reference for the knowledge of the art of Gandhara, with implications for the entire field of study.

All the pieces have been studied individually and, with analysis of the stylistic and iconographic features of the subjects portrayed, they have been sorted into series, and the series brought together in groups. Although certain differences can be detected in each of the series, each group has its own way of distributing the figures over the field, and its own system to insert the scenes depicted within the architectural panel of the relief.

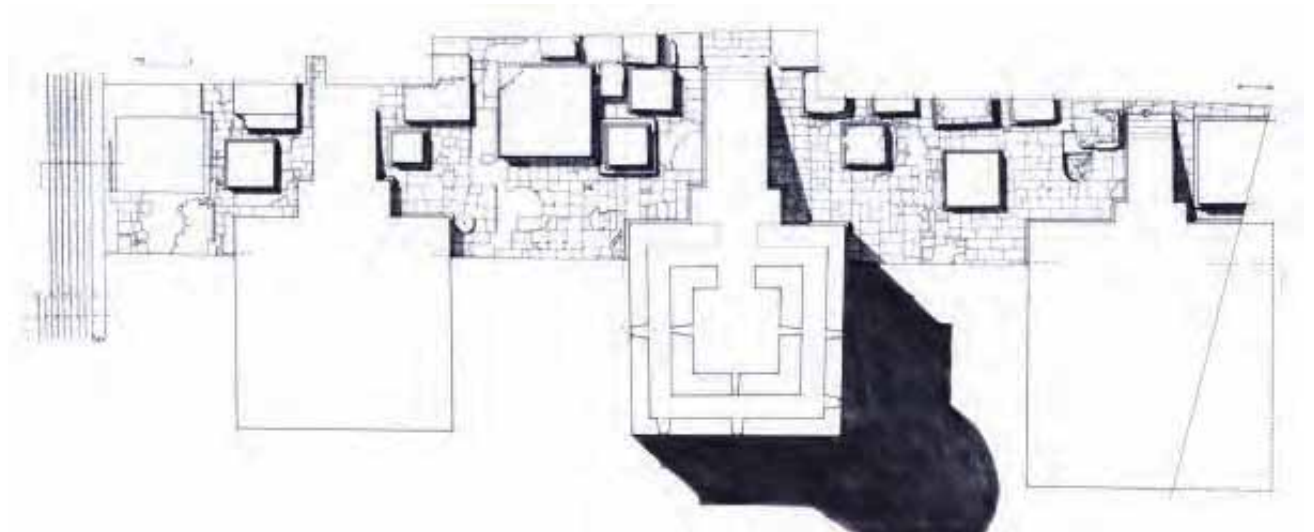
Particular significance is assumed in the various groups by the reliefs that were reworked – those cases in which the slabs on which reliefs had been sculpted were subsequently reused, hewn to fit the new use and sculpted on the other side with another representation. The stylistic differences of the groups can readily be recognised on the two sides of these reliefs, thereby giving these groups a relative chronological position, while absolute chronology can be attributed on the evidence of excavation data – at least for some of the series



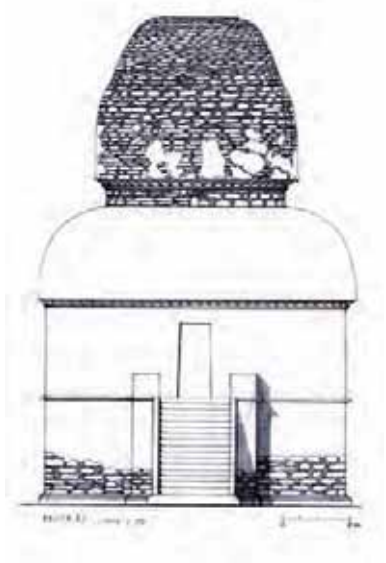
– as from the first half of the 1st century CE, while the remainder find relative placing as subsequent or contemporaneous.  
 The lines thus traced out for the artistic production of the Butkara I centre apply only to this and, in part, other Swat centres.  
 In particular, fragments of a sculptural frieze from the Great Stupa of Saidu Sharif I are attributable to a single great artist denominated the “Master of Saidu Sharif”, associated by stylistic approach with the group described as “drawing” and dating to the mid-1st century CE.

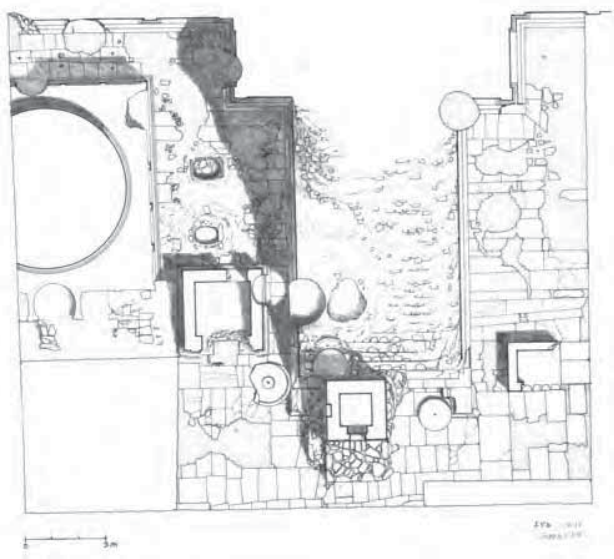
## MUSEUM GALLERY 6

### GANDHARAN ART AND ARCHITECTURE: GUMBAT AND AMLUK-DARA

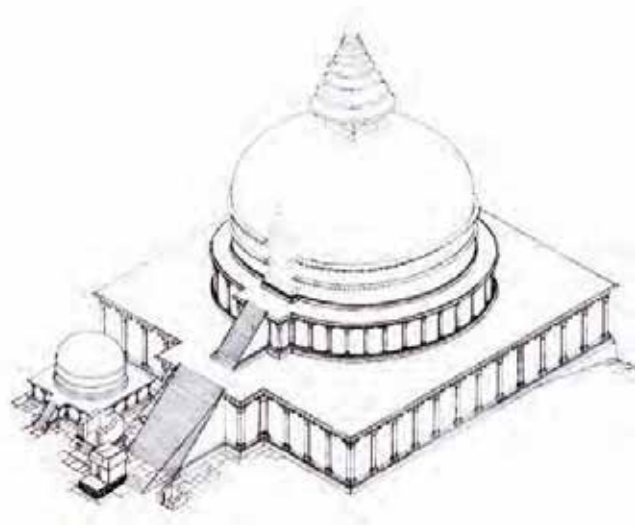


**Gumbat-Balo Kale  
 (Kandak Valley, Barikot )  
 2nd century CE**





Amluk-dara (Karakar Valley, Barikot)  
2nd-9th centuries CE



GANDHARAN ART AND ARCHITECTURE:  
NIMOGRAM (1st-3rd CENTURIES CE)







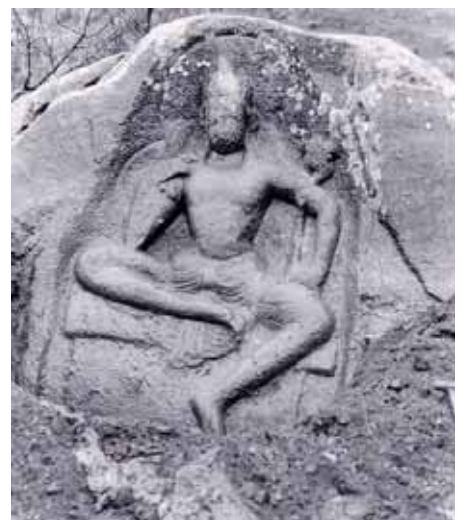
## MUSEUM GALLERY 7

### POST-GANDHARAN BUDDHIST ROCK-CARVINGS (7th-8th CENTURIES CE)

This is a relatively large-scale artistic production which flourished in Swat (and, to a lesser extent, in adjoining areas) during the 7th-8th century CE and whose subjects are almost exclusively Buddhist with only a few exceptions, as in the case of those representing Surya, Ganesh and Shiva. The reading of this iconographic subject, which had been already proposed some years ago on the basis of scanty elements, has been very recently confirmed by new discoveries. Although their formal language was borrowed from the local traditions, these reliefs clearly belong to a different cultural horizon. The most recent interpretation suggests their intimate connection with the presence in the region of the Turki-Shahis and their royal ideology.

Usually executed on rock walls as well as on roughly cut stelae, these sculptures represent the last artistic expression of the Buddhism in Swat. Near 200 rock-sculptures have been so far recorded. Significantly, they mostly condense around some of the surviving Buddhist sacred areas, along the left bank of the Swat River, between Manglawar and Barikot.

The numberless repetition of Buddha and Bodhisattva figures, sometimes combined in strange and asymmetric compositions, had since long conveyed the erroneous impression of an ingenuous, popular expression of faith. On the contrary they revealed a richness of meanings, adapted to the shape of the rock and to the landscape.





#### LATE-HISTORIC SETTLEMENTS (7th-10th CENTURIES CE)

Mention here must be made of the first excavation campaigns in the built-up areas of Udegram ("Bazaar" and "Castle") and Gogdara, carried out between 1956 and 1961

The "Castle", locally known as "Raja Gira Castle" shows an occupation sequence from early-historic times to the visible fortified structure built in Hindu-Shahi times (9th-10th century CE). The "Castle" was only the major stronghold of a wider fortified area that encompasses the ridges overlooking the Udegram plain and encloses a permanent spring ("Kushal Khan-china").

Another sector of secular architecture that has come under investigation is that of the fortified centres of the late-ancient and Hindu-Shahi periods dotting the hillsides in the southern stretch of the Swat Valley. In Hindu-Shahi times there was in Swat a highly organised defensive system based on certain architectural typologies (forts with round bastions, and watch-towers) besides the existence of fortified villages ("kot"), which main feature is the recurrent use of "tower houses" buildings. The "tower-houses" villages have been dated to Turki-Shahi period (7th century CE).

#### LATE-HISTORIC BARIKOT (7th-13th CENTURIES CE)

The northern terrace of the Barikot acropolis was extended around 7th century CE with a huge monumental substruction wall for a sacred complex that dominated the Middle Swat valley. Of the Turki-Shahi Temple that stood at the centre of the terrace remains the massive base constructed on a rectangular plan (25 x 12.5 m) with a flight of steps giving access on the eastern side, decorated with pilaster strips faced with a plastering of stucco displaying decoration in relief, upon which the cella originally stood.

Important attestations of figured decoration in stucco were found in the structural remains amid the collapsed material, as well as fragments of cult images in marble (Gadadevi, to the left), which can be ascribed to the art of the Shahi period (7th-11th century CE) on the stylistic evidence, and attributed to a Brahmanic cult. The dating of the two structural phases of this period also finds confirmation in C 14 analysis.

After a ruinous collapse imputable to an earthquake, the area was occupied by a new group of overlords who followed to conquered Swat in the 11th century in the wake of Mahmud of Ghazni.







## MUSEUM GALLERY 8

### EARLY ISLAM: THE GHAZNAVIDS (11th CENTURY CE)

In 1984 an inscription in Arabic engraved on a block of marble was found by chance on the northern slopes of the hill that rises above the village of Udegram (identified by Stein and Tucci as the ancient Ora, dating back to the times of Alexander the Great). The find was made at a point on the great terrace halfway up the hill, below the "Castle", whose later levels represented a fortified residential area of the Ghaznavid period.

The inscription attests to the foundation of a Mosque in HE 440 (1048-1049 CE), ordered by emir Nushtegin, a Ghaznavid general unknown to us from the sources. It was in fact in the wake of the armies of Mahmud of Ghazna (today Ghazni), in the 11th century, that Islam arrived in Swat, preceding the penetration of the Pashtun peoples now constituting the majority of the population.



The excavation carried out in the area between 1985 and 1999 brought to light a hypostyle Mosque with supports originally in wood and, adjacent to it, a settlement lying to the West of the *qibli* wall.

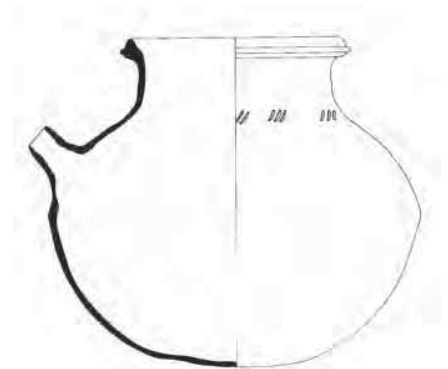
The Mosque occupies an early artificial terrace with remains of Gandharan masonry. Not far from the entrance to the Mosque, to the East, have been brought to light the remains of a small Buddhist sanctuary, certainly already in ruins at the advent of Islam, while another must have stood to the West of the terrace.



The Mosque of Udegram dates back to the period of Mahmud or his grandson Mawdud (1041-1050 A.D.), and is therefore to be considered the earliest of Northern Pakistan.

A singular occurrence was the discovery, in a late phase, of skeletons in accidental position in the *ziyyada* of the Mosque (above).

By the end of the 12th century the residential area to the West of the Mosque was already in a state of abandonment and was being used as a cemetery area. Like almost all such areas in Swat, the area had grown around the tomb of a saint, upon which a small and simple mausoleum was erected. From some of the graves datable to the third decade of the 13th century, coins struck by the Khwarezm Shah were retrieved.



The first Islamic period occupation in the Swat valley is also attested in the excavations of Barikot, both in the plain and on the hilltop.





A drawing by Robert Powell

## MUSEUM GALLERY 9

### WOODEN ARCHITECTURE ( 17th-20th CENTURIES CE)



Lower and Upper Swat hold a heritage of wood architecture with intaglio decoration whose beauty is equaled by their cultural importance. The heritage consists mainly of Mosques, together with various sanctuaries and a smaller number of civil structures.

From the planimetric viewpoint, the Mosques situated in lower areas of the Swat Valley generally consist of two rooms. A rectangular room, closed in on all four sides, constitutes what is known as the "winter Mosque", where prayers are held in the coldest months of the year, while the other room, open on one or more sides, porticoed and often somewhat less regular in shape, is known as the "summer Mosque". In the mountain areas, on the other hand, the buildings normally consist of a prayer-room preceded by a verandah, which may continue along one side forming an L-shaped plan.

These architectural structures are often adorned with superb intaglio work rich in reminiscences of the sculpture of Gandhara, and of the refined production of Indian Islam, as well as interesting elements of Central Asia and vestiges of the early folk traditions of Dardic and Kafir origin.

Alas, this extraordinarily rich artistic heritage is now in serious danger under the pressure of rapid social and economic change: few of the civil works of architecture are left, while many of the Mosques have been demolished and replaced with anonymous buildings.

### LIVING TRADITIONS

#### WOODEN HANDICRAFT (17th-21st CENTURIES CE)

The profound links between this activity and the cultural past of the region, the persistence of the material and the techniques used, is demonstrated by the importance of the role played by craftsmen still today in the economy and in the society. This pro-





ductive activity provides a good observation point for enhancing our understanding of the cultural and social context of Swat.

The most active areas have found where there is an active commercial activity like Khazakhela and Madyan, but also in side-valleys like Supal-bandai (close to Saidu Sharif) and Chamtalai.

Where craft activities are carried on, traditional architecture is best preserved. A continuity of the study and the researching activity will help to contribute to the conservation and sustainable recovery of rich architectural heritage and an intangible legacy, made up of knowledge and technique handed down from generation to generation.



## List of Acronyms

### Institutions

|       |   |
|-------|---|
| ACT   | Archaeology Community Tourism-Field School Project  |
| AJK   | State of Azad Jammu and Kashmir   |
| DOAM  | Department of Archaeology and Museums (Government of Pakistan/Government of Khyber-Pakhtunkhwa) |
| EAD   | Economic Affairs Division   |
| ERRA  | Earthquake Reconstruction & Rehabilitation Authority  |
| FDMA  | FATA Disaster Management Authority  |
| IAM   | Italian Archaeological Mission in Pakistan  |
| INGO  | International Non-Governmental Organization   |
| IsIAO | Italian Institute for Africa and the Orient (formerly IsMEO)                                    |
| IsMEO | Italian Institute for Middle and Far East   |
| KP    | Khyber-Pakhtunkhwa Province (formerly NWFP)   |
| MAE   | Ministero Affari Esteri   |
| NWFP  | North-West Frontier Province  |
| PISDA | Pakistani-Italian Debt Swap Agreement   |
| SNS   | Sar Nevesht Saz   |
| UET   | Department of Civil Engineering University of Engineering & Technology of Peshawar              |
| UTL   | Unità Tecnica Locale Pakistan   |

### Technical terminology

|        |                            |
|--------|----------------------------|
| C.S.M. | Cement-Sand Mortar         |
| D.P.C. | Damp Proof Course          |
| P.C.C. | Plain Cement Concrete      |
| R.B.C. | Reinforced Brick Concrete  |
| R.C.   | Reinforced Concrete        |
| R.C.C. | Reinforced Cement Concrete |



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Architects specialized in "Technology and Architecture of Developing Country Urban Areas" and in "Engineering of Emergency", with 12 years of experience working in Development and Emergency Programs within a setting of Italian and local Government, UN Agencies and INGOs. as Acting Programme Coordinator, Programme Manager, Construction Manager, Urban and Project Designer in Eritrea, Italy, Mali, Montenegro, Pakistan and Sri-Lanka.

### International Works\* in Pakistan

**2011 to 2013 in Saidu Sharif, Swat, Construction Managers and Coordinators for ACT's Project, Government of Italy, DOAM and Government of Pakistan.**

Reconstruction and rehabilitation of Swat Archaeological Museum

**2010 to 2011 in Shangla District I. Marati as Programme Manager and Acting Programme Coordinator for INGO CORDAID (Caritas Network) IDP Emergency Programme (Health, Shelter, Water Sectors) in response of conflict with Taliban.**

**2009 in Lahore, Islamabad, Pakistan. I. Marati as Investment Promotion Expert for UNIDO (United Nation Industry Development Organization) Officer-in-Charge of IPU (Investment Promotion Unit) to identify and promote investment opportunity between Pakistani and Italian Small and Medium Enterprises**

**2007 to 2008 in District of Manshera, NWFP, Pakistan. I. Marati as Construction Manager for INGO CORDAID (Caritas Network)**

Construction of N. 2 High Schools and N.9 Primary Schools. Rehabilitation of 100 houses, rehabilitation of road and water supply scheme.

**2007 in Muzaffarabad, Abbotabad, Mansehra and Neelum District. Technical Advisors for UNESCO and INGO ISCOS-CISL in:**

- Consultancy for Support Services for Supervision of Pre-fabricated Training cum Office Building Development in Muzaffarabad AJK;
- Typological and Constructive Analysis for the definition of design and evaluation of the minimum standard for Transitional School Shelter Building for Middle and Secondary Schools.

**2007 to 2008 in Muzaffarabad, Abbotabad, Mansehra and Neelum District Pakistan. C. M. Vassallo as Technical Advisors for UNESCO in:**

- Construction monitoring of Pre-fabricated Training cum Office Building Development in Muzaffarabad AJK;
- Technical Specifications for Design & Construction and Financial Evaluations of semi-permanent and permanent Workshop and Schools Building in North West Frontier Province (NWFP) and in the State of Azad Jammu and Kashmir (AJK).
- Specification of High, Middle Primary and Nursery Schools and Workshop's furniture in NWFP and in AJK.

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### Other international Works\*

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**2004 in Youvarou, Region of Mopti, Mali. Construction supervisors; Project designers and Tutors for Ngo Terranova, Ngo N:EA ; Onlus GRAD in:**

- Construction of Services and Social housing;
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**2003 in Kolasin, Montenegro. Urban Planners for EAR (European Agency for Reconstruction), Luis Berger, Polytechnic of Turin as part of team working on Urban Planning.**

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- Planning of camps in post war emergency.
- Evaluation of appropriate techniques for the planning and construction of housing and basic services for IDP in post war emergency

### Works\* in Italy from 2001 to. 2006 Designer Construction Managers, Urban Planners

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- Requalification of Urban Park in Afragola (NA);
- Urban Development Plan in Nola (NA);
- Executive design for the Reconstruction of Theatre "Colosseo" in Baiano (AV).

for prof. arch. Sandro Raffone's Architectural Studio in:

- Rehabilitation of buildings in historical centre of Naples;
- Reconstruction of residential building and bed & breakfast in Naples;
- Construction of show-rooms in Naples;
- International competition "Parco Nazionale del Cilento e Vallo di Diano" winner of the first prize selected in the first phase, Salerno.

\* All works have been executed by I. Marati and C. M. Vassallo if not differently indicated.