



2013 On Site Review Report

4016.IND

by *Laurence Loh*

Rehabilitation of Nagaur Fort

Nagaur, Rajasthan, India



Architect

Minakshi Jain

Client

Mehrangarh Museum Trust

Design

1993 - 2006

Completed

2009 - ongoing

Rehabilitation of Nagaur Fort

Nagaur, Rajasthan, India

I. Introduction

The ancient city of Nagaur in the Marwar region of central Rajasthan was one of the first strongholds of Muslim power (12th–16th century) in northern India. Located on a major caravan route, it was also an important centre of Sufism and, at its height, the presence of celebrated Sufi sheikhs made it a place of learning and pilgrimage, with its many fine mosques, tombs and other monuments associated with this period of Muslim rule. At its heart, Ahhichatragarh (translated as “cobra-hood fort”), the Fort of Nagaur, with its palaces and Mughal water gardens, once stood proud, where its walls rose high above the low-rise historic crossroads town in the centre of the region.

Built over many centuries the Fort embodies the city’s long history of shifting power struggles and displays a fine blend of Rajput and Mughal architecture. Altered over time, including after India’s independence when it was occupied by the state government and then later by the Border Security Force, both of whom carried out unsympathetic renovations to the historic buildings, the decline of the Fort into utter disrepair is a microcosm of the rise and fall of the Indian and British empires and the pastoral activities in the region.

The painstaking and never-ending restoration, rebuilding and revitalisation of Ahhichatragarh (1993–2013) is today a shining testament to non-profit, private investment, social responsibility and the unwavering collective human spirit that has saved a built legacy for future generations. With the passage of time, it will increasingly transmit the cultural and historical values once embedded in the place, conveyed through the purity of architectural space and plan.

II. Contextual Information

A. *Brief historical background*

A summary of historical dates and events is outlined below:

- 500: Nagavanshi kings construct a mud fort
- 858: Nagaur, a Pratihara empire, many temples built
- 1112: Muhammad Bahlim captures Nagaur from Behram Shah
- 1119: Muhammed Bahlim constructs the fort wall in stone
- 1192: after the defeat of Prithviraj III, a Chauhan king in Tarai, Nagaur and Ajmer become centres of Muslim rule
- 1226: Sultan Illutmish captures Nagaur
- 1278: Nagaur ruled by Delhi dynasties
- 1305: Mongol leader Tarquak invades and destroys Nagaur
- 1408: Shams Khan becomes the first ruler of the Khanzadas of Nagaur
- 1418: Shaheed Minar on the south wall of the Fort was constructed in memory of Shams Khan

- 1427: Rinmal, son of Rao Choonda, regains Nagaur after defeating Firuz Khan, son of Shams Khan
- 1435: wife of Shams Khan constructs a well in Nagaur near Shamas Talab
- 1527: the independent Khanzadas lose to the Lodis of Delhi
- 1528–40: reign of Sarkhel Khan, last of the Nagaur Khans, son-in-law of Maldev
- 1540: Rao Maldev kills his son-in-law and captures Nagaur
- 1570: Akbar visits Nagaur and gifts it to Rai Singh of Bikaner
- 1626: Jahangir gifts Nagaur to Raja Gaj Singh I of Jodhpur
- 1638: death of Raja Gaj Singh; Nagaur under his elder son Roa Amar Singh
- 1656: Rai Singh, son of Amar Singh, enthroned by Aurangzeb after Amar Singh
- 1679: Indra Singh, son of Rai Singh, becomes the king
- 1707: Rao Ajit Singh enthroned in Jodhpur and in the following year, he invades Nagaur
- 1724–51: Mawar, ruled by Rao Abhay Singh, and Nagaur comes under Raja Bakht Singh (his younger brother)
- 1751: Nagaur becomes a part of the Marwar state
- 1752: death of Maharaja Bakht Singh

The following excerpt is from the book *Asia Conserved. Lessons Learned from the UNESCO Asia-Pacific Heritage Awards for Culture Heritage Conservation (2000-2004)*:

“The Nagaur kingdom is believed to have been established by the Nagvanshi kings who built the original mud fort in the fourth century. Ahhichatragarh was built on the site of the mud fort between 1119 and 1121 by a Muslim ruler. In 1154, a number of major modifications and additions were made to the fort complex but few further changes were made until 1540. The fort was a coveted prize and Nagaur’s strategic location and importance as a trade centre meant that the town was the setting of a number of conflicts as a series of Hindu and Muslim rulers battled to retain control. After 1540, successive additions were made to the fort complex until 1752, when the last building was constructed.

“The fort complex was occupied by the Rathors of Jodhpur from the late eighteenth century until 1947 when the state government began renting the complex. One of the government departments, the Border Security Force, adapted the buildings to create barracks and other facilities and occupied the site for over a decade. When the Force vacated the complex in 1970 it remained unused for a further 30 years.

“Over its long history the fort has been subjected to weathering. In the past century it suffered more from neglect than damage from conflicts. Ever since it was vacated by the Border Security Force, the fort deteriorated dramatically from natural causes and vandalism. Encroachments to the moat area by residences and shops have detracted from the overall attractiveness of the outer walls, while incompatible structures built adjacent to the main gate had compromised its original use. Pilfering of stones from the wall for off-site usage has led to structural instability. The historic water system was completely abandoned. Roofs leaked badly and were overgrown with vegetation. Beautiful mural paintings had been damaged by water or whitewashed over. Iron clamps holding arch brackets together had failed due to formation of rust. Stone elements and plaster were cracked, projecting architectural features were missing and the flooring was damaged. The external fort walls suffered

massive damage. However, owing to the solid stone construction, none of the buildings had collapsed totally, a testament to traditional building technology. Most of the structural damage was partial, being limited to the domed and large span roofs, foundations, columns, slabs and bracket arches.”

B. *Local architectural character*

The buildings in the Fort were built and rebuilt over many centuries, mainly in the Rajput and Mughal styles. At one time the Fort was surrounded by a moat.

The Fort, with a site area of 145,686 square metres (approximately 36 acres), 60 low-rise buildings and five palaces, is entered via a single barbican entrance on the east, followed by another six successive gateways before reaching the royal compound itself which is surrounded by an inner wall.

The final built landscape of the palace complex celebrates the height of Mughal architecture in India, where the strong spatial organisation in its totality and the graceful proportions of the palaces, pavilions, semi-outdoor and exterior spaces softened by the presence of water and planting are expressions of purity in the materiality of the red sandstone of Rajasthan, the rhythm of carved, bracketed columns and ever-changing perspectives articulated by movement through the site.

C. *Climatic conditions*

Nagaur has a tropical desert climate, extremely cold from October to February and scorching hot from March to September, with temperatures rising as high as 48°C in summer. At night, summer temperatures hover around 20 to 29°C. The average rainfall is 300 millimetres, falling mainly in July and August. The local weather, once predictable and faithful to its seasonal timetable, has in recent memory become unpredictable as a result of climate change. Flash rains can bring up to 508 millimetres in a day, causing damage to the heritage fabric that was never designed for high and intensive rainfall. Cracks and vulnerable flat roofs designed for a dryer climate become victims of incremental destruction for which the owners of the Fort have no easy solution.

D. *Site and surroundings*

At its inception, Ahhichatragarh was located on the highest ground, around which the city grew. It had six lakes around it to draw water to the Fort. Presently, the historic town, with its two – to three – storey high, flat-roof houses and narrow meandering streets, surrounds the Fort. The open space of the Fort acts as the green lung of the historic settlement.

E. *Topography of project site*

Built on a small hillock, the topography of the Fort’s plinth itself is generally flat. The rest of the city is also relatively flat and unexceptional in terms of contours.

III. Programme

A. *History of the inception of the project*

In 1985, the Fort was placed in the care of the Mehrangarh Museum Trust (MMT), a non-profit foundation established by His Highness Maharaja Gaj Singh, who now acts as the Managing Trustee. The Trust is dedicated to preserving local cultural heritage and seeks to reduce local unemployment levels and poverty through supporting the training of artisans and promoting the revitalising of traditional building skills, crafts and local performing arts.

In 1993, the Trustees appointed Minakshi Jain as the principal conservation architect and director of the project, with a vision to embark on one of the largest architectural conservation projects in India within a non-governmental structure, with a clear brief to employ the highest standards of architectural conservation practice with minimum intervention and to bring life back to the spaces for visitors to experience, appreciate and enjoy.

Because of financial constraints, initial conservation efforts were minor, concentrating on preventing further damage, particularly to important wall paintings in the main palaces. In 1996, the MMT was awarded a grant for 250,000 USD for a period of two years by the Getty Foundation, which it had to match.

Conservation work began in June 1998, beginning with the Krishna Temple, one of the most auspicious buildings on the site. It was a testing ground for material quality and construction methods. In June 2001, the planned works, focusing mostly on structural stabilisation and major buildings conservation, were completed. From 2002 until today conservation works of one kind or another continued, the latest being in the form of archaeological works in the east compound. Funding continues to be sought for further research, restoration and repair to lesser structures and to continue research and exploratory works to extend the partially restored water systems in the complex.

B. *How were the architects and specialists chosen?*

Ms Minakshi Jain and her husband, Mr Kulbhushan Jain, an architect/planner, came to the attention of the MMT CEO (who has since retired) when they sought permission to conduct a group of architectural students from Ahmedabad on a study tour of the Fort in the mid 1980s. When MMT applied for a grant from the Getty Foundation in 1991, the Jains came to mind and they were co-opted into their team. At that time, the Jains were also involved in the preparation of the Historic City Report for the City of Jodhpur.

The support consultants for structural and electrical services were selected from their home city of Ahmedabad, while the landscape designer was from Delhi, the nearest metropolitan city to Jodhpur.

C. *General programme objectives*

The brief was to bring life back to a highly significant but derelict heritage site for the enrichment of future generations, to restore its historicity in the spirit of minimum intervention and to recover the Fort's spirit of place so as to re-establish a thriving and breathing presence within its painstakingly conserved walls, palaces and gardens. The site would be activated by embedding a collection of museum spaces to serve the core activities of historical and conservation interpretation and public use for events and accommodation.

The main aim of the project was to conserve the entire complex as a physical ensemble, emphasising historic authenticity. Given that funding was limited, however, careful planning was undertaken to ensure maximum impact in critical areas.

The buildings were to be restored and made suitable for modern uses. Through the use of traditional methods and materials in its restoration, the project also aimed to re-establish customary skills and create new opportunities and livelihoods for the local people.

The walls had to be stabilised and checked to prevent further damage while it awaited more comprehensive treatment. In addition, the grounds and open spaces of the complex were to be returned to their former condition, in order to encourage the use of the complex by the local people as a gathering place for festivals, meetings and seminars.

A related objective was to increase public awareness of the heritage value of Ahichatragarh and appreciation of and pride in cultural heritage in order to revive local rituals and enhance community cohesion.

Finally, the ultimate goal was for the complex to become an architectural museum and a living laboratory for students of traditional architecture.

D. *Functional requirements*

To repair roofs and ceilings: most of the roofs in the Fort had deteriorated, being under stress from the environment for long periods;

To repair cracks on the rooftops: the main causes of cracking were deteriorated terracing layers, choking of roof drainage, unequal settlement of load-bearing members and vegetative growth on the roofs;

To save painted ceilings: painted ceilings are an important element of this palace complex. These had started to deteriorate due to the cracks in the roofs;

To restore wooden ceilings: due to leakages in the roof of Bakht Singh Mahal, the wooden ceiling over the first floor had deteriorated and was infested with termites. Some of the members, such as joists and purlins, had been damaged and they had to be replaced with new ones.

IV. Description

A. *Building data*

The total site area is 145,686 square metres or approximately 36 acres. The length of perimeter walls of the Fort is 1.8 kilometres. The total ground floor area is 22,161 square metres (or 88.26% of the total floor area) and the total built-up area inclusive of basements, ground floors and all upper floors is 25,110 square metres. In relation to the overall site the covered structures constitute only 15.2%. These consist of 60 small and large buildings and five palaces. The rest of the site is open space and landscaped gardens which consist of seven water bodies, four wells, one step well, a hundred fountains and six courtyards.

Remarks: Table showing areas of each building/location and a site plan identifying names of buildings is available.

B. *Evolution of the design concept*

The primary objective was not to focus on conserving single buildings but to restore, revitalise and protect the whole Fort complex to arrest further damage and to plan for full public access. To achieve this, the conservation works had to be in sympathy with the surviving architecture and the historicity of the site in order to enhance visitor experience.

From day one, the aim was to activate and maintain the place as a living site, with adaptive reuse in mind. Forward planning took this eventuality into consideration. A range of activities were envisaged, which include interpretation of local heritage, crafts training programmes, conservation and restoration workshops and site visits, cultural performances, fairs and festivals, seminars and conferences, hospitality as well as religious ceremonies. Without the active participation of people, the whole conservation exercise would be meaningless.

C. *Structure, materials, technology*

1. *Structure and construction*

The buildings of the Fort were built at different periods using the three universal and historical materials of stone, lime and wood. While each structure maintains its own special character, taken holistically, the successful juxtaposition and association of buildings on site read as a well-planned, pleasure-palace complex. Architectural spaces are a fine combination of enclosed, open and semi-open spaces, which is reflected in the admirable organisation of gardens, courtyards and terraces throughout the plan.

The span limitation of stone slabs governed the width of covered rooms and spaces. Domes were used for wider spans. Stone ceilings and domes were supported by load-bearing walls and columns supported bracketed arches, to create *baradaris* (colonnades punctuated by stone pillars). A variety of bracketed openings appear like constructed arches. Carved stone elements such as *jalis*, *takiahs* and brackets, lighten the appearance on the monolithic, outer stone facades, while fine paintings and

mirrors embellish and distinguish the interiors. Most buildings have projected weather sheds and plinths, and water is channelled through a well-developed system of canals, fountains and reservoirs.

This large project has depended on small innovations, mostly created by the site team (staff, workers, builders and contractors). These were manifested in issues related to: how to remove accretions without damaging historic details; how to locate underground fountains and drains; how to recover mural paintings behind plastered or whitewashed wall surfaces; how to carry heavy stone and lime sacks; how to simplify hand-cut carvings and devise new tools; how to run water fountains for specific effects, and so on. It was a labour-intensive project.

This project has enabled the conservators to rediscover materials and construction methods of an earlier era, many of which have stood the test of time and nature. In order to maintain the historic character of the Fort, most materials used in its conservation were the same as those used in the original construction. However, some new materials, methods and small machines were introduced for added strength, quicker production pace and resilience suited for adaptive reuse. The selection and procurement was carried out to match the historic features of the buildings, subject to availability, quality, quantity and cost of the materials.

2. *Conservation methodology*

The project involved a number of stages, beginning with a thorough assessment of the damage to understand the causes of failure and deterioration.

After an appraisal of the complex, the buildings and fortifications were then documented in detail, showing the site condition and allowing conservation measures to be drawn up. Vegetation on the roofs and courts was cleared to prevent further damage by the penetration of roots into the structure. Inappropriate additions such as partition walls were removed in order to restore the original layout and ambience. An investigation of the water system was carried out at the same time with a view to eventually restoring the buildings' original water-cooling and distribution system.

Following this, the stone roofs were repaired by strengthening the substructure, repairing cracks and refinishing the surfaces with lime concrete. The wooden ceilings, damaged by water ingress and subsequent termite attacks, were repaired, resealed and treated against termites. The ornate ceiling paintings were saved.

It was suspected that uneven settlement of the foundations had led to the formation of wall cracks and the displacement of arch brackets. In some cases, the walls were dismantled, and the foundations were given a proper base after removing loose soil and underlying vegetation and roots. In other cases, the ground was dug up in alternating 70-centimetre sections, and the foundation base and trenches were filled in with lime concrete.

Cracks were then filled, grouted, pointed and plastered. The arch brackets were repaired through the insertion of new stainless-steel U-shaped rods at the apex. All exterior plastered surfaces were merely stabilised; new plaster was applied only in the interiors. In addition, the lime flooring was repaired and doors, screens and windows in the original style and materials were installed.

3. *Historic materials*

- Stone: walls, roofs, columns, brackets, railings, *jalīs* (carved stone screens) and other elements are either in yellow ochre sandstone of Khatu (name of the town, from where stone is brought) or in red Jodhpur stone. Stone for the project was recovered mainly from debris and purchased for new carving work, flooring, *chajjas* (eaves), *jalīs*, railings and replacement pieces where original elements were missing or broken;
- Lime: fat lime or stone lime was used in the conservation works due to its enduring use and quality in historic buildings. Various grades of lime were used according to the requirement of plastering, masonry, terracing, and so on. The proper slaking of lime is crucial to the production process and to obtain a lustrous plaster, lime was soaked for six months;
- Sand: coarse sand was used to mix in and make lime mortar;
- Grit: grit was used to make a hard base for flooring, roofing and so on;
- Gypsum: for urgent strengthening, gypsum was used;
- Mortar mixes: traditionally, *gud* (jaggery) and *guggal* (gum) work as binding materials and *methi* (fenugreek) to make the mortar waterproof. The concoction ensured malleability of the mortar;
- Wood: acacia, sal and teak woods were used;
- Glass: historically, stained glass was used in stone *jalīs* in some of the palaces. Missing or broken pieces were replaced after proper research had been carried out, subject to availability of the correct glass.

4. *New materials*

Steel: historically, iron was used for fastening building components. However, due to the rusting of iron, joints and brackets were found in damaged condition, stainless steel was used instead in the project.

Glass: in some of the new doors and windows float glass was used to bring light in to the darker areas.

D. *Origin of technology, materials, labour force, professionals*

Since the buildings in the Fort were built at different times, each one has its own set of unique features. The architecture of these buildings has been thoughtfully merged. Today the complex reads as one. Most interestingly, some buildings are built on top of older ones. Buildings are a good combination of enclosed and semi-open spaces. Spanning limitations of stone determine the width of spaces. Domes are used for wider spans. Stone roofs or domes are supported by load-bearing walls.

This large-scale project has supported innovations by masons, supervisors and old caretakers: for example, how to remove accretions without damaging historic details; how to locate underground fountains and drains; how to discover paintings behind the whitewash; how to carry heavy stones and lime sacks; how to simplify hand-cut carvings by devising special tools. It was a labour-intensive project. When the project started in 1993, all drawings were hand-drawn. There were no computers on site. Today all office staff are equipped with computers. Many may not have had any formal education, but they are creative, ingenious and wholly committed to the Fort.

Manual labourers employed on the project were local or from nearby villages. These labourers/craftsmen required very little training to work with conventional methods and techniques and using conventional materials, particularly lime. This is very important in the context of modern materials (like cement, admixture etc.) and using modern methods. The people were happy to follow and safeguard their traditional systems. Most of the materials – like lime, gypsum, stones, fresh water and so on – were bought from local markets and nearby villages, thus providing considerable economic support to the local community.

V. Construction Schedule and Costs

A. History of project design and implementation

The conservation works were carried out in several phases. The table below is a summary of the timing and scope of each phase of work.

Phase	Description of Works	Start	End
1.	Initial documentation, urgent repairs, entrance area	January 1993	April 1994
2.	Palaces, fort wall and other buildings	October 1998	April 2002
3.	Remaining buildings, fort wall and open spaces	April 2004	February 2007
4.	<i>Ranvas</i> (Queens' Palaces), fountains, gardens	April 2005	November 2008

B. Total costs and main sources of financing

	Local currency	US dollars
Total initial budget	85,662,417 INR	1,968,671 USD
Total actual costs	85,663,417 INR	1,968,671 USD
Actual cost (per square metre)	588 INR	13.51 USD

Sources of Funding are as follows:

No	Phase	Amount in USD			
		Getty	HHT*	MMT	Total
1.	Phase I	32,676	-	32,676	65,352
2.	Phase II	250,000	-	268,434	518,434
3.	Phase III	250,000	-	254,531	504,531
4.	Phase IV	-	302,082	578,272	880,354
	TOTAL	532,676	302,082	1,133,913	1,968,671

*Helen Hamlyn Trust, UK

C. *Comparative costs*

Nagaur being a small town with availability of manpower and material mostly from the local area and nearby villages, the actual costs for the project were considerably lower when compared to big cities and government projects. Labour and craftsmen were almost 25% to 30% cheaper. Similarly, the materials available nearby are suitable. Due to minimal transportation, these were available at considerably cheaper rates.

Modern materials/techniques are expensive, but the use in such projects is not extensive. Although the processing of traditional materials – like slaking of lime, preparation of mortar, and so on – costs a bit more, it is worthwhile as the life of the materials is longer when compared with modern materials.

As can be seen, the amount of work accomplished is incalculable compared to the funds expended. The costs in a private initiative are always carefully controlled in comparison with government projects. In a private company, the administration expenditure is kept to a minimum and expenses on site are well controlled.

D. *Qualitative analysis of costs*

As detailed in subsection C above, the conservation cost per square metre is 588 INR or 13.51 USD, which is very low and very reasonable when compared to modern construction rates in the market for similar works. However, with inflation, this is increasing.

E. *Maintenance costs*

The annual financial budget for maintenance is 25 lakhs INR or 50,000 USD.

F. *Ongoing costs and “life performance” of building*

Apart from regular maintenance of the buildings there is a need to continue with remaining and additional conservation works as and where required on the property. These include the revival of fountains, water systems and gardens, waterproofing of the restored Fort walls from the top (ramparts), conservation works required in remaining buildings/palaces, conservation of wall paintings and so on. Budgets for such ongoing works are allocated on an annual basis. The life performance of the buildings already conserved is satisfactory as the conservation has extended the life of the buildings considerably.

VI. Technical Assessment

A. *Functional assessment*

As there are multiple public uses planned for the site, the conservators and designers ensured that the functions and user needs were integrated into the management regime.

Visitor circulation and control: a well-planned visitor route has been established for guided tours. As large vehicles cannot navigate through the gates, the entry of visitors is carefully monitored and controlled as visitors enter on foot if they arrive by bus outside the Fort gate.

Site interpretation: being a historic monument and public domain, good interpretation enhances the visitor experience.

Museum: the site has been laid out as a palace site-cum-museum with interpretation panels installed in strategic locations.

Accommodation: the *Ranvas*, or Queens' Palaces, have been converted into hotel suites and are available all year round.

B. *Climatic performance*

The conservation work, with its character-defining elements of thick walls, window and door openings, screens (*jalis* and *takiahs*), verandas and pavilions (*baradaris*), courtyards and water bodies, comprehensively restored and rebuilt, has re-established the operative principles of responding to the climatic conditions of an arid, tropical desert setting.

C. *Response to treatment of water and rainfall; discharge of water and retention and release system*

The uncovering and restoration of an intricate and ingenious water retention system that had fallen into disrepair and been buried has brought back to life a series of fountains and pools that help to moderate the microclimate of the various spaces within the Fort complex. The historic water system primarily served as a water gathering and conservation system. Used water was collected in various open ponds and sedimentary tanks and filtered through a natural sedimentation process incorporated into the system.

Water is very important in an arid area. Those who planned the palaces took great care not to waste water. Rainwater is very precious and has always been conserved and collected, explaining why so many water bodies were constructed. Water management is, in fact, one of the underlying concepts, the linking agent behind the overall planning. There was a unique and extensive system of redistribution, of running water through aqueducts, channels, basins, fountains and tanks before it was finally used for gardening purposes.

Historically, the contours of the land within the Fort were formed so that water drained to the east and south. On the west, two depressions gathered water. This is an area where droughts occur every few years but sometimes rains are very heavy. The rainfall pattern is not uniform.

For drainage of rainwater, rain collecting tanks have been constructed at certain strategic points to capture the water. Excess rainwater is collected in the existing water bodies and depressions.

Water in the existing wells and step-well within the Fort contained very high TDS (totally dissolved solids) and fluoride and is not suitable for conservation works. These water bodies were de-silted and

cleaned to improve the water quality. In addition, a proper water filtration plant was installed to enhance the water quality.

A sewage treatment plant has been installed in one part of the Fort, specifically in the *Ranvas* (Queens' Palaces), where most of the effluent is collected and treated and the treated water is then reused for irrigating all the planted areas. In other parts of the Fort where effluent quantity is minimal, small soak pits have been constructed for disposal of the effluent.

D. *Environmental response*

As this is a conservation project, it sits within an existing micro-environment which has prevailed since its inception. Endemic flora has been reintroduced into the site. The water conservation and collecting system described above is historically one of the most prominent environmental responses in the project.

A modern-day environmental response is the low carbon footprint of the conservation works.

E. *Choice of materials, level of technology*

To embed the principle of minimum intervention, only traditional materials that matched the existing were used, employing traditional craft and artisan techniques and workmanship to restore, replicate and replace damaged or missing sections in a seamless fashion.

All materials and processes/techniques matched those used in earlier times, particularly the preparation of lime mortars, the installation of the lime flooring/roofing, the process of plastering, the erection of masonry, and so on, where all works were executed following traditional practices. The reason behind choosing such materials and techniques is very obvious. Most of the areas only required patches of such repairs. It is a known fact that the same material should be used to allow for bonding with the older work.

Compaction of lime floors and roofs was executed with either smooth stone or wooden compactors. In earlier times, women used to sit in a line and pound on the laid slab continuously for several days. This allows the water to spread and dry out in an equal fashion, homogenising and compacting the slab.

Mortars were also prepared using local traditional techniques. Fat lime or stone lime was used in the conservation work on account of their distinguishing qualities as building materials. Different grades of lime were used according to the requirements of plastering, masonry mortars, terracing, and so on. The proper slaking of lime is crucial. The minimum slaking period was one month. To obtain a lustrous plaster, lime was slaked for approximately six months.

Traditionally mortar mixes were made with the additions of *gud* (jaggery) *guggal* (gum), *methi* (fenugreek) and jute fibre/sheep hairs as binders and waterproofing materials. *Gud*, *guggal* and *methi* were boiled together for eight days and this concoction was added to lime and sand to make mortar.

Gypsum was used to accelerate setting. Coarse sand from the Binawas River was used due to its excellent quality. Fresh water from local wells/water bodies was used in the preparation of mortar.

F. *Response to, and planning for, emergency situations*

Most of the buildings are single- and double-storey of stone set within vast grounds. Emergencies like fire are not expected. The only problem is with the huge Fort walls. Due to a lack of knowledge about the stability and nature of the existing foundations and movement, damage to them may occur over time. These are readily repaired.

G. *Ageing and maintenance problems*

The conservation works are in themselves a form of high-end maintenance, which reversed or removed latter-day accretions that were harmful to the site. The site had fallen into disrepair and century-old historic structures were never restored when they deteriorated, and walls literally crumbled. The process of “ageing” has been arrested, routine maintenance is ongoing and change is managed.

A Conservation Management Plan was drafted in 1993 with broad guidelines. All buildings and grounds were documented and assessed. Their final presentation and reuse was specified. The phasing was worked out in accordance with available funding. As works progressed, details were developed or modified. In this manner, conservation and reuse works were carried out simultaneously. This resulted in savings and in reducing the overall costs.

H. *Design features: massing and volume, articulation of spaces, integration into the site*

As this is an existing historic site, where the focus was on restoration, design interventions were minimal and, where required, were aligned with functional needs. Where new elements were introduced they were sympathetic and respectful, while representative of their contemporary context.

History shows how spatial and temporal interventions have been a normal process of change in any architectural complex. New structures are added or modified by subsequent rulers. Such interventions become part of the history and heritage of a place. This process of historic evolution has been captured by respecting the various periods in the conservation works.

From 1993 to 2013, the palaces and courts were conserved as an open-site museum with interpretation panels strategically introduced. There were no new interventions within the main palace complex. On the other hand, the *Ranvas*, or the Queens’ Palaces, have been adapted as residences for tourists to stay overnight. Here facilities and infrastructure have been added, but within the existing footprints, where materials and forms were retained.

I. *Impact of the project on the site*

The physical impacts on the site are minimal. The environmental impact is negligible because the project has a very low carbon footprint as all materials and workers can be found locally. Very often

existing materials on site were recycled. There is no disturbance to the ground of the site as there are no new building activities connected with major earthworks and the erection of new buildings that require excavations for foundations.

Water is a highly valued resource because of its relative scarcity. The large site's needs amount to 3.65 million litres per year, of which 1.0 million litres are collected in tanks and ponds from natural sources. Where tenable, the used water is also recycled.

Environmental pollution levels generated by vehicular traffic are presently low as foreign visitor numbers are still under control. Large vehicles cannot enter the site due to the narrowness of the gates. The owners envisage introducing a wide variety of programmes and activities so that there is no reliance on mass tourism to generate much-desired income. Specialist events like the Sufi Music Festival, conservation workshops and provision of retreats for scholars for on-site research are some of the ideas already put into place.

The restoration of the water gardens and the replanting of endemic trees throughout the 14.56-hectare site (almost 36 acres) to create a luscious public open space in the centre of the city will act as a climatic filter and green lung.

J. Durability and long-term viability of the project

With the major restoration works completed, conservation of the complex will be an ongoing process of continuous research and maintenance. This has enabled the Fort to become a laboratory for experts, scholars and students to study its remarkable architectural history and artwork. The heightened awareness of Ahhichatragarh's value as a historical and architectural resource will increase efforts to preserve it for future generations.

The public's awareness of the iconic value of a precious monument in their midst has increased levels of appreciation of local heritage. It has created employment and new sources of income with the influx of visitors. The catalytic effect on the local hospitality and tourism industry is already being felt. This alone will ensure that the community will continue to retain an interest in protecting and preserving the Fort, as well as encourage and support the ongoing cultural, social and religious activities within the site.

Revenue capture is embedded in the daily tours in the form of entrance fees, as well as in the 36 hotel rooms in the *Ranvas*, or Queens' Palaces, that are now in operation. As visibility increases, the owners hope that the operations will eventually be self-sustaining, especially as more visitor products will be added attractions, not as gimmicks but as a result of new discoveries and specialist cultural events that are compatible with the site's heritage values.

The conservation of the Fort will also contribute to the historical continuum in the local, regional and national context. This in itself will feed into the state's larger cultural tourism and development agendas. New synergies between the site and the local context will be created. The big picture is that the long-term viability of Ahhichatragarh is ensured as a result of the convergence of several driving forces.

Note: This viewpoint is developed further in the “Conclusion” under the reviewer’s “Personal Appraisal of the Project”.

K. *Ease and appropriateness of furnishings*

The major spaces of the restored palaces are minimally furnished as many of the original pieces have been lost. The *Ranvas*, or Queens’ Palaces, that occupy the western section of the complex have been restored and adapted to create 36 hotel bedrooms. These have been tastefully furnished with pieces that evoke a strong Rajasthan character. The bathrooms exhibit local characteristics that cater for the local style of bathing. The overall effect conveys a distinct interior design appearance that reflects the climatic conditions of semi-outdoor living, private courtyards and rooftop terraces.

VII. Users

A. *Description of those who use or benefit from the project*

Users include:

- worshippers who visit the four Hindu temples and a mosque within the Fort’s compound;
- individual visitors and tour groups;
- hotel guests;
- participants of specific events and festivals;
- research students;
- local citizens.

Beneficiaries include:

- people involved in the tourism industry;
- employees in the hotel;
- workers and craftsmen involved in the conservation works;
- conservation professionals.

B. *Response to project by clients, users and the community*

The client is indeed happy with the results and continues to be encouraged by the increasing visibility of the site. The client’s employees are very happy working on the site as they confirm that it is for them a new and challenging but rewarding experience. They are learning new things every day. On the consultants’ side, the junior employees are grateful for the training that the project offers. The exposure to conservation on this magnitude and complexity is rare.

The local community takes pride in having an iconic site that places Nagaur on the map and are pleased because the local economy is expanding with the increase in tourism arrivals.

VIII. Persons Involved

Project personnel and their roles in the project

Managing Trustee:	His Highness, Maharaja Gaj Singh
Architect/Planner:	Ms Minakshi Jain
Administration:	Mr Mahendra Singh (Rtd.) CEO, MMT
<i>Ranvas</i> (Queens' Palaces) Planning and Furniture:	Lady Helen Hamlyn
Concepts, Museum:	Mr Martand Singh
Administration/Museum Director:	Mr Karni Jasol
Consulting Architect/Planner:	Mr Kulbhushan Jain
Executive Engineer:	Mr Shailesh Mathur
Site Engineer:	Mr Surendra Harsh
Supervisor:	Mr Shiv Singh
Electrical Consultant:	Mr Harshad Jhaveri
Fountain Consultant:	Mr K.K. Patel
Water Supply and Sanitation:	Mr Arvind Mewada
Landscape Consultant:	Ms Priyaleen Singh
	Mr Pradip Krishen
Textile Consultant:	Ms Madhurima Patni
	Ms Brigitte Singh
Junior Architects:	Ms Poonam Jolly
	Mr Jitendra Sharma
Draughtsman:	Mr Sunil Prajapati
Contractor:	Mr Dilawar Khan
	Mr Safi Khan
	Mr Poonam Chand
	Mr Ghevwar Chand
	Mr Arjun Prajapati
	Mr Ashok Makad
	Mr Emamuddin
	Mr Jagdish Prasad
Contractor and Master Craftsman:	Mr Gokul Ram Makad
Master Craftsman:	Mr Mooi Chand
	Mr Sukha Ram

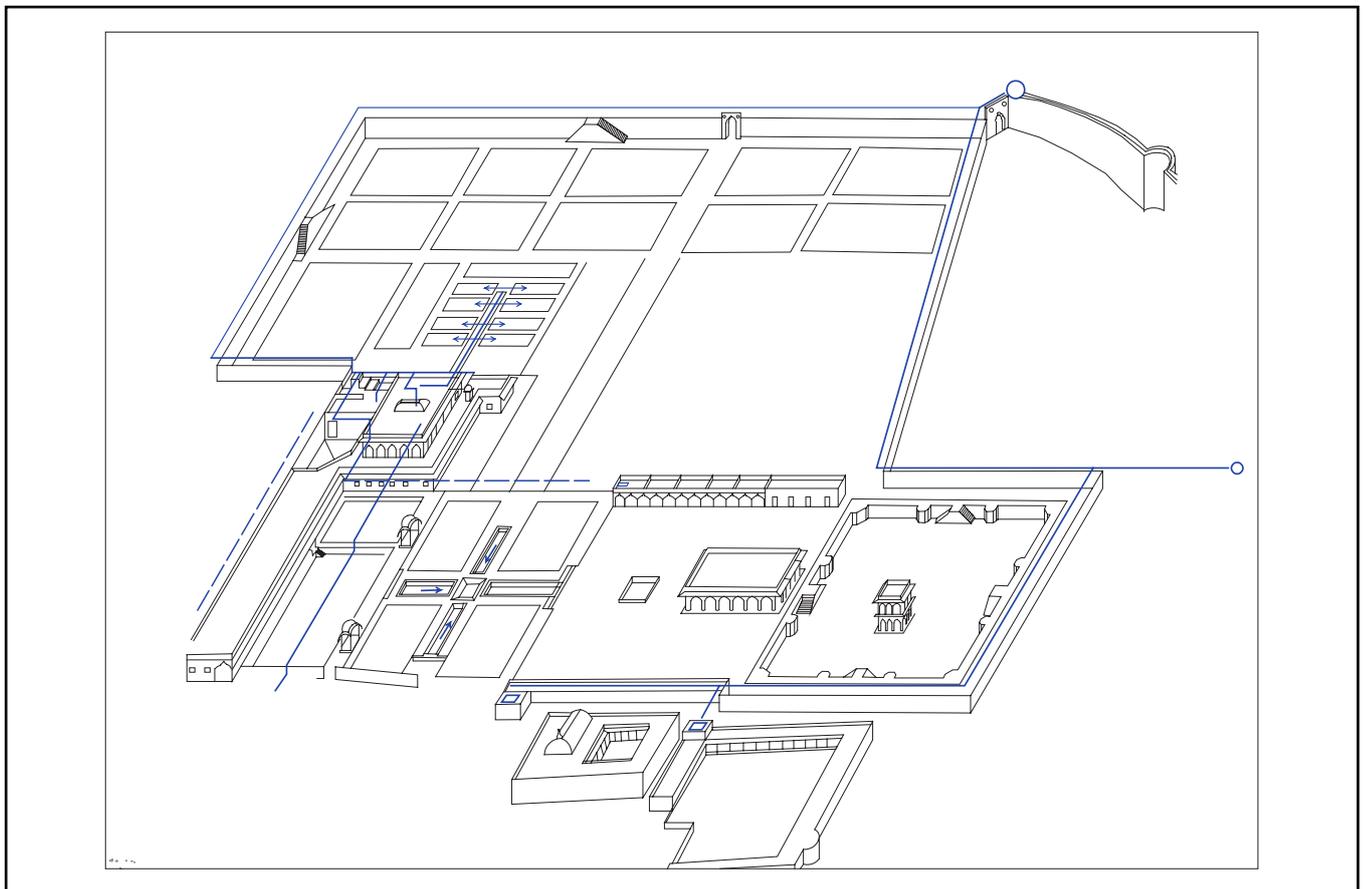
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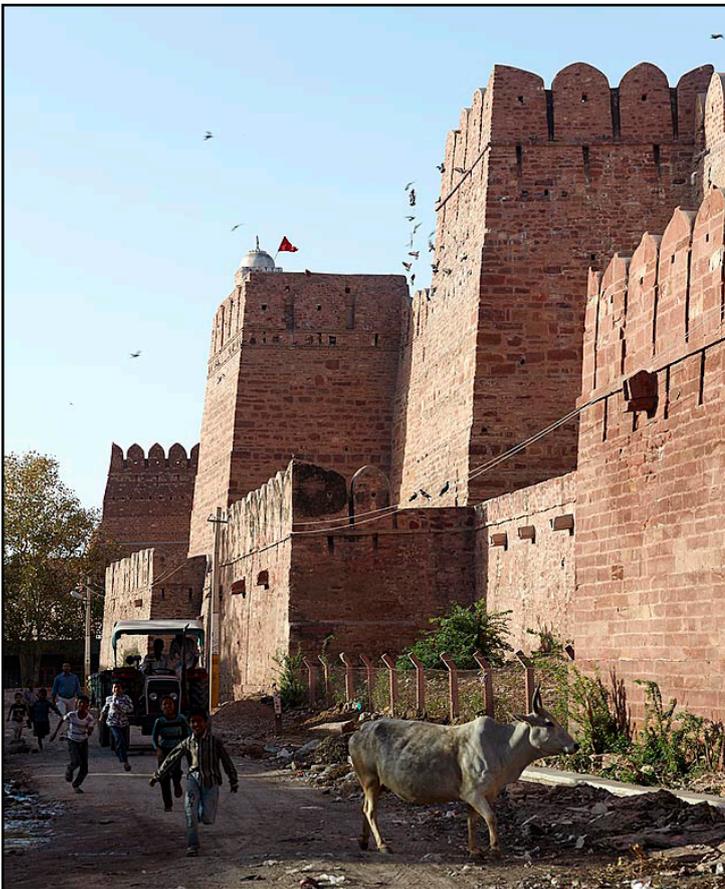
Laurence Loh

April 2013





At its inception, Ahichatragarh was located on the highest ground, around which the city grew. It had six lakes around it to draw water to the Fort. Presently, the historic town, with its two- to three-storey high, flat-roof houses and narrow meandering streets, surrounds the Fort. The open space of the Fort acts as the green lung of the historic settlement.

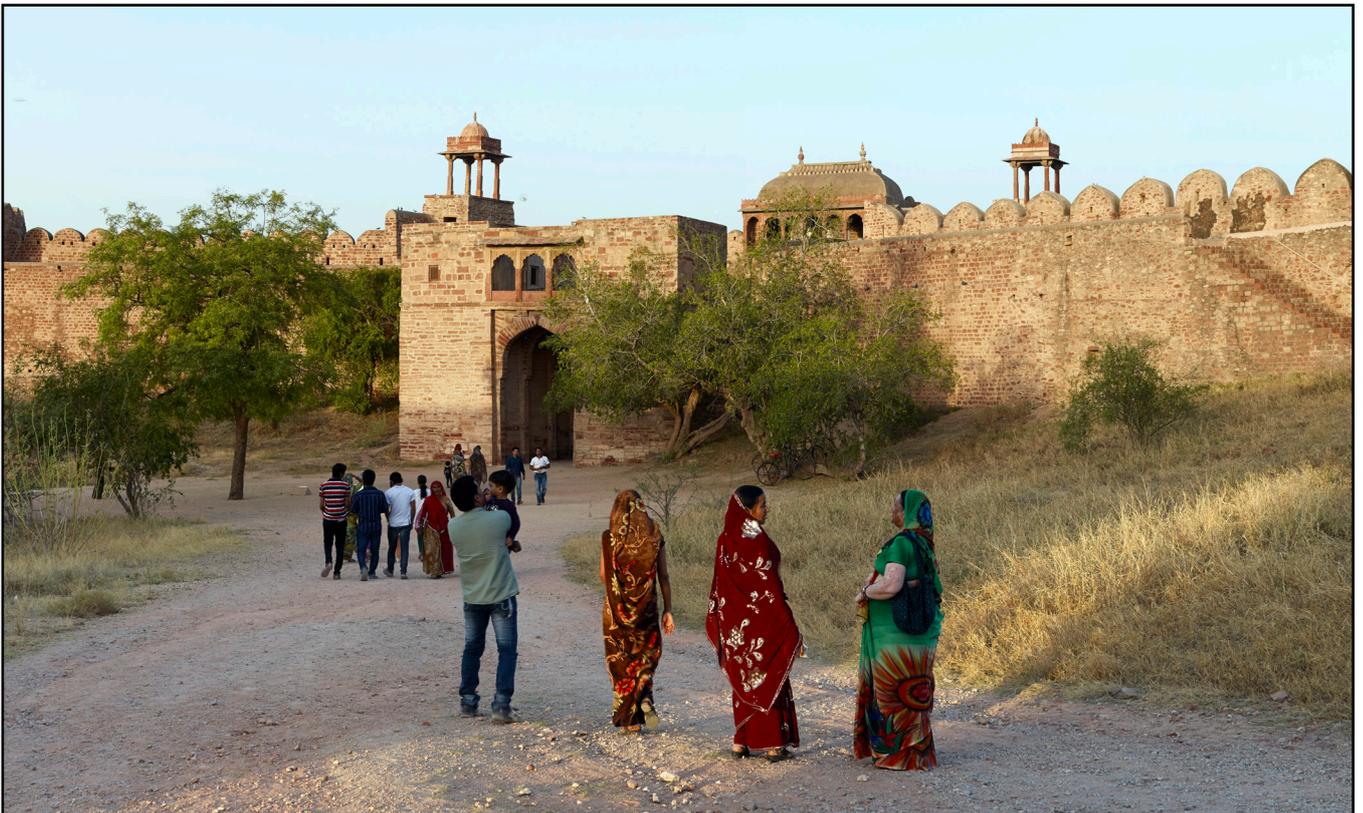


The Fort, with a site area of 145,686 square metres (approximately 36 acres), 60 low-rise buildings and five palaces, is entered via a single barbican entrance on the east.



External fort wall before restoration.

The visitors have to go through six successive gateways before reaching the royal compound itself which is surrounded by an inner wall.





Bhakt Singh Mahal before conservation. After an appraisal of the complex, the buildings and fortifications were then documented in detail, showing the site condition and allowing conservation measures to be drawn up.

Bakht Singh Mahal after restoration. This consists of the Shees Mahal, an entrance pavilion, a Muslim prayer space and a hammam, all of which were built to host Akbar during his visit to the Fort around 1570.

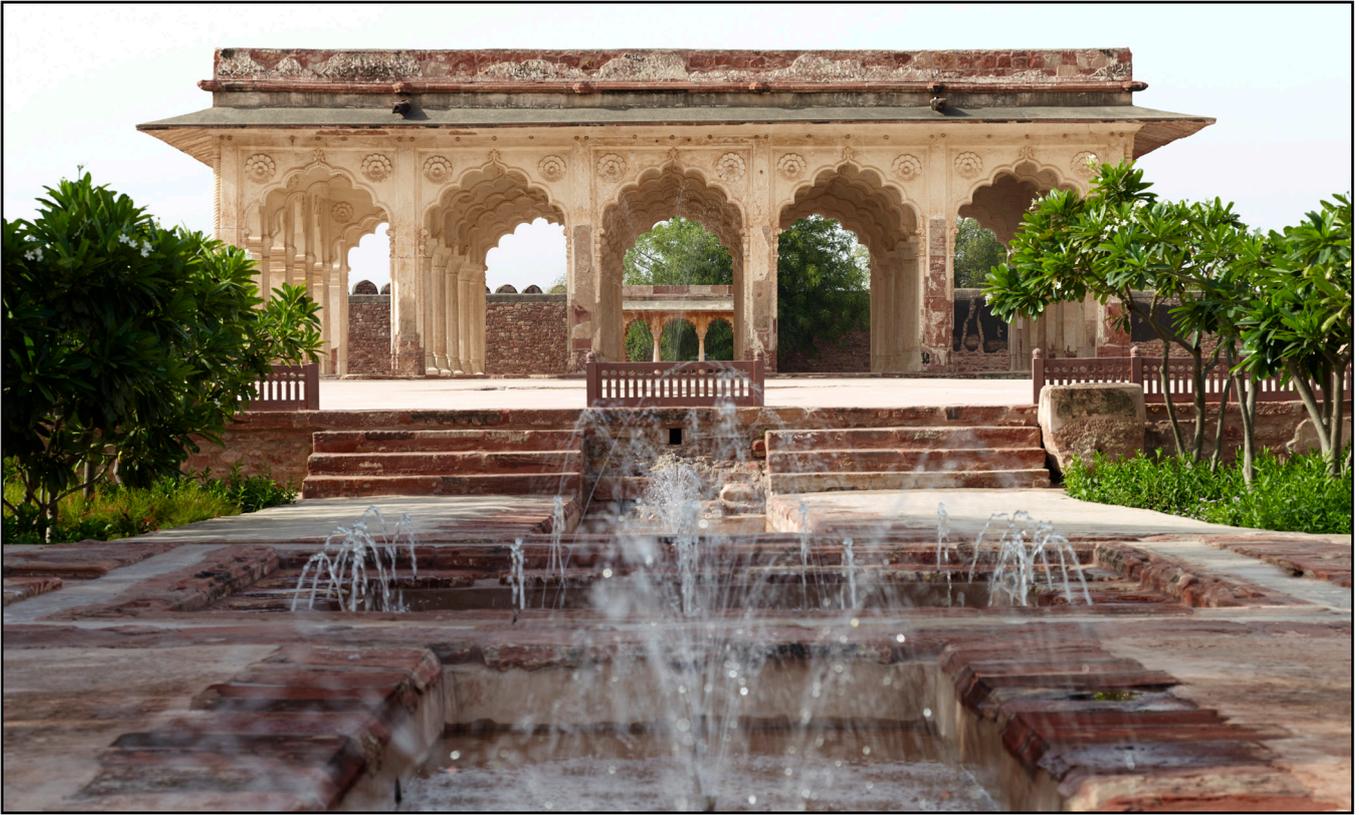




The Hadi Rani Mahal before conservation.

This project has enabled the conservators to rediscover materials and construction methods of an earlier era, many of which have stood the test of time and nature. In order to maintain the historic character of the Fort, most materials used in its conservation were the same as those used in the original construction.





The uncovering and restoration of an intricate and ingenious water retention system that had fallen into disrepair and been buried has brought back to life a series of fountains and pools that help to moderate the microclimate of the various spaces within the Fort complex.



Water travels to the terraces of AbhaMahal, and is brought down through two vertical chadders, than gets connected to a basin with fountain, finally over flowing in to the horizontal passage.



A variety of bracketed openings appear like constructed arches. Carved stone elements such as jalis, takias and brackets, lighten the appearance on the monolithic, outer stone facades, while fine paintings and mirrors embellish and distinguish the interiors.

Specialist events like the Sufi Music Festival, conservation workshops and provision of retreats for scholars for on-site research are some of the ideas already put into place.

