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# Of earth, stone and wood: the restoration and conservation of a Buddhist temple in Ladakh, Indian Himalayas

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**Topic:** T4.1. Conservation and restoration projects of vernacular architecture

***Abstract***

*The Dukhang Yokma is a small Buddhist temple part of the Ensa monastery in the Nubra river valley in Ladakh. The Dukhang was severely damaged by water infiltration soon after its construction at the beginning of the 20th century. Water seepage through its stone and mud mortar plinth caused a gradual bulging of the foundations which was followed by a steady shift of the whole structure. In the course of several decades this shift became irreversible and gradually damaged most of the masonry structure. The building had been neglected for several years before an active interest in its preservation emerged. During this time, several parts of the buildings were dismantled and the temple's inner chamber on two storeys tilted almost to the point of collapse. The conservation, consolidation and restoration of the temple has been undertaken by Achi Association India from 2018. This article analyses the restoration project and its many challenges, including wall painting stabilization. It explains in detail the issues faced by Achi team members and the way these problems were resolved through making use of local resources in this remote hermitage. One of the most complicated issues was to bring the inner temple's structural elements back to their original straight position, avoiding any collapse and damage of the wall paintings. The complexity of the task was due to the very fragile mixed structure on two storeys made of wood, mud bricks and stone.*

***Keywords:*** *conservation, Buddhist temple, traditional and local construction techniques, Ladakh.*

## 1. Introduction

### 1.1. Ladakh: context background

The Ensa monastic complex is located in Nubra valley (Ladakh - India), on the western side of the Nubra river bank, and in the South-eastern most stretch of the Karakorum range. Ladakh in general falls in a rain shadow area that has very scarce precipitations (< 100mm. $yr^{-1}$). It is a high-altitude cold desert that can experience temperatures reaching down to -40 °C during winter or rising up to 35 °C in the short summer months (Ferrari, 2018: 23). It is mostly due to climate change that summer precipitations have drastically increased in recent decades. Rain often causes devastating flash floods, which become even more dangerous due to the barren terrain that is easily prone to erosion. Precipitation is currently one of the most hazardous threats to architectural heritage, which is also jeopardized by a rapid substitution of historical buildings, reconstructed with imported materials and without local or national regulation.

### 1.2. Architectural Conservation in Ladakh

In the last decades, efforts towards the conservation and restoration of architectural heritage, and material cultural heritage in general, have increased in Ladakh. Nevertheless, there exists no policy structure for addressing the preservation of cultural heritage or for regulating interventions for its restoration. It is not unusual to

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find historical constructions that have been demolished and replaced by new ones. These acts are often prompted by good intentions to 'renovate' a degraded building, or improve it, and not solely out of a lack of socio-cultural and historical knowledge of a more complex discourse on material heritage. There are several national and international organizations as well as other institutions that have worked on the architectural and artistic heritage of Ladakh. The most widely recognized ones include INTACH (Indian National Trust for Art and Cultural Heritage), the Archaeological Survey of India, Achi Association, Tibet Heritage Fund, and HCHF (Himalayan Cultural Heritage Foundation). Interventions on material heritage in Ladakh have been fragmented and are of extremely varying degrees of quality partly due to the absence of a local policy and regulatory body, and partly because over the years restoration works have taken place in an arbitrary and piecemeal way.

### 1.3. Achi Association

Achi Association is one of the organizations actively working in Ladakh. It was founded in the 90s by individuals and scholars dedicated to the preservation of Buddhist heritage, mostly specialising in the early art and architecture of the Himalayas. Achi's approach has always been interdisciplinary, unifying specialists from Europe and India who combine in-depth research with hands-on preservation (archaeology, art history, painting and architectural conservation). Because of the well-known lack of regulatory policies on material heritage, Achi's main efforts have been directed towards preserving unique pieces of art and architecture, for example the Lotsava Lhakhang in Kanji, different interventions in the village of Wanla, or the fort in Skyurbuchen. For more than 20 years, the association has given priority to the most ancient and unique artefacts that risk being lost forever.

## 2. The Conservation of the Dukhang Yokma

An interesting opportunity emerged in 2018 for Achi that was different from previous projects on Ladakhi cultural heritage. This new occasion was fostered by Nubra's local authorities and their concerns about a series of historical buildings in the valley. Among these constructions, a small temple (dukhang) had long fallen into disrepair. The particularity of this building lay not just in its intrinsic artistic value or rarity, but in the fact that for the first time, local authorities demonstrated interest in mobilizing public resources for a project centred on a careful conservation initiative. Achi India was appointed to lead this endeavour. The initiative began in 2018, while the major intervention took place in 2021, with long-lasting interruptions due to seasonal pauses as well as the Covid-19 pandemic and completed in 2022. This very complex process took place with the help of several national and international collaborators and often through digital communication and remote coordination due to the difficulties of working in such a remote site.

Fig. 1. The dilapidated roof of the Dukhang Yokma (middle ground) and the main monastic complex in the background.

### 2.1. Preliminary analysis: structural issues and oral history

The temple was initially surveyed by Achi in 2016 and another research campaign was conducted in 2018 to analyse the structural issues of the temple together with a detailed documentation of the oral history on the temple's founder and related construction activity. The study of the oral history regarding the temple's foundation was carried out with a series of interviews in three villages, directed to understand the

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monastery construction and the life of its founder, Danma Trulku. Several elders from these villages recounted anecdotes from their personal or their parents' lives which were documented. The study also focused on a folk song that is still widely known in Ladakh today, and is about the founder and his personal life in relation to the Ensa dukhang.

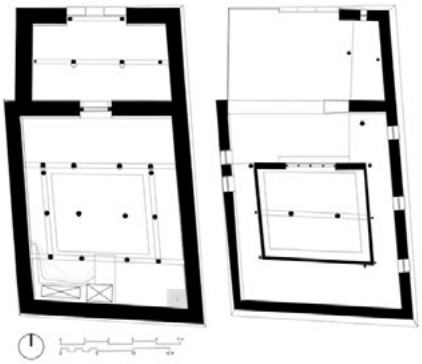

Fig. 2. Ground floor (left) and first floor (right) plans. Image credit: Hilde Vets architect.

These missions were helpful to understand the reasons behind the early damage of the foundations. This damage took place not long after the construction (approximately early 20th century), along with a steady and progressive instability of some of the main masonry sections of the temple. Following a series of geomantic speculations, the monk Danma Trulku (founder), decided to place the statue of a protector deity in a depression near the older monastery in order to prevent negative influence towards the village of Panamik, on the opposite side of the valley.

According to the monk, it was necessary to erect a small temple to host the sacred object. This is the reason why the temple, as compared to most of the local buildings, rises in a very inappropriate location for construction (Fig. 3). This concave area is prone to water accumulation due to the presence of a natural underground spring. In the past, water coming out in winter was freezing in layers and slowly flooded the porch, thereby damaging the mud mortar in the plinth. The damage caused a progressive bulging of the foundation of the highest wall, and the temple started an unstoppable rotatory and shifting process.

Fig. 3. The Dukhang Yokma seen from Panamik (centre).

Fig. 4. Main entrance and porch. The temple started to shift from this corner at the base of the walls (North-east).

This shift firstly involved the porch and the room above it, which dragged all the rest of the structure towards North (Fig. 4-5-6). Oral accounts reported that this process began early after the construction, until large cracks appeared. The upper room on the first floor was completely dismantled as a precaution measure (Fig. 4), and the deity statue inside the temple was also removed. The temple quickly decayed, especially in the last 20 years.

Fig. 5. Bulging plinth with eroded mud mortar (North-east).

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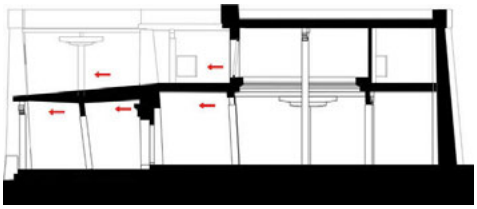

Fig. 6. Vertical section North-South (2016). The structure progressively shifted towards North. Image credit: Hilde Vets architect.

### 2.2. The conservation initiative and its several constraints

Only in 2021, the local authorities in Nubra secured public funding for the conservation and partial reconstruction which had to be swiftly employed before the end of the same year. Achi paired its expertise and also the work of volunteers in order to execute the project. Time was a major constraint for the project (the building season only lasts from May to September), as well as the formation of a working team of experts and craftspeople for the execution of the project. Moreover, in spring 2021, there was a paucity of building materials because of the rapid re-start of construction activities after almost two years of interruption. Regarding the temple's position, Ensa lies very close to the line of control, thus being very distant form all major urban centres in Ladakh.

Since the temple is surrounded only by steep rocky slopes, any material apart from stone which can be quarried not far from the site, should be brought from other locations. The vehicular road ends 300m lower than the monastery premises, thus all materials brought there by truck have to be carried by hand to the site. For this reason, apart from the well-known time limits, there were several logistic impediments to the successful completion of the project.

Fig. 7. The severely damaged, tilted, and detached walls on the first floor of the temple's chamber (North-west corner).

### 2.3. Solving structural issues: a hands-on and experience-based approach

This section presents a summary of the works that were carried out in three phases. The coverage is too short to present all details, thus the main focus is on phase two and the solution of the main structural issues, which included the straightening of the existing tilted inner structure of the temple. In phase one, the whole porch was dismantled until the foundations. A new and deeper trench of 120cm depth was dug (the original was often only 30 cm or less).

Fig. 8. Reconstruction of the porch with new dry-stone foundations.

All of the three walls were rebuilt utilizing the older material integrated with larger stones taken from the mountain to form a stronger plinth and better interconnections for the corners. All masonry that was underground was rebuilt with the dry-stone technique (Ladakhi: *skam rtsig*)[1] to avoid any possible erosion of the

[1] A stone wall built without mud mortar (Ferrari, 2021: 70).

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mortar at the base. New walls were rebuilt of the same size (120 cm at the base), only enlarging the one on the western side which had to be increased due to its original thickness (60 cm only) and with an average batter on the external side of 10-12°. The main stabilisation of the wall painting was also carried out during this initial stage. With the new porch walls in place, phase two of the project could commence. Phase two brought forth the most challenging structural issues of the building, which were related to straightening the two-storey structure inside the inner chamber of the temple (Fig. 9).

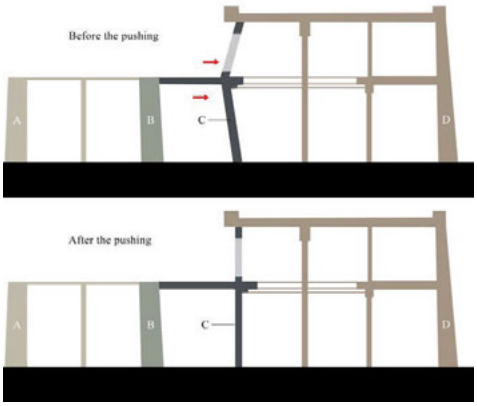


Fig. 9. Schematic view of the structural intervention concept. A - rebuilt porch (phase 1); B - tilted wall of the entrance with paintings; C - mixed structure on two storeys with paintings (phase 2); D – rest of the temple (phase 3).

This section is constituted by a mixed material structure. On the ground floor, there are four wooden columns with capitals, topped with wooden beams and a composite frieze of wood, mud bricks, and stone. While on the first floor, is a thick wall of mud bricks (50-60cm) and stones with a large wooden sky light/window (Ladakhi: *rgyam thong*) (Fig. 10). The main challenge was to preserve the integrity of the mural paintings on the first floor during the pushing and repositioning of the entire two storey structure. This meant that it was not possible to simply dismantle the wall and roof above it, straighten all wooden ground floor structural elements, and rebuild the masonry on top of it. This two-storey mixed structure had to be pushed entirely, while still attached to the rest of the temple, avoiding any collapse in order to save the murals.

Fig. 10. Tilted wooden opening on the first floor (left); covering the paintings with a protective cloth near the wooden window (right).

Fig. 11. One of the main beams slid 25cm outside its original position (North-eastern corner).

Before this operation could take place, a temporary structure had to be installed to guarantee a safe and successful operation.

This work took a considerable amount of time during phase two and consisted of: creating a composite wooden beam in three pieces propped on all sides to support the roof in between the main temple's door and the inner chamber (Fig. 12); erecting three high wooden composite props with supporting beams (9m) for the roof of the inner chamber (Fig. 13);

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building a wooden frame for the projecting beams above the skylight (*rgyam thong*) (Fig. 14); fitting temporary shutters made of plywood fixed with steel rods crossing the wall through its cracks in order to stabilize the mud brick structure for the time of the pushing and avoid any severe damage to the walls and paintings (Fig. 14); and inserting a pushing system made of wooden members attached to hydraulic jacks for the mechanical straightening of the structure (Fig. 15-16).

Fig. 12. Temporary beam at the entrance of the chamber.

Fig. 13. Composite props of pre-cut timber and local poplar.

Fig. 14. Installation of plywood panels to temporarily lock the mud brick and stone walls with paintings. In the centre, a series of props are put under the cantilevered poplar beams.

Along with these preliminary works it was necessary to insert cantilevers under some of the beams resting on the entrance wall once all of the beams in the walls were uncovered (Fig. 17).

Fig. 15-16. Installation of the props with hydraulic jacks (left). Fixing a temporary load distribution timber frame on the columns and beams (right).

This operation was mandatory since the tilted stone wall could not be straightened back to its original position. The reason is that by pushing these beams back towards the inner chamber, many of the wooden elements would have fallen outside the wall edge that could not be shifted with them.

Fig. 17. Placing cantilevers under some of the beams of the entrance hall and fixing them to the stone wall.

Fig. 18. Insertion of wooden tie beams (*sket shing*).

Other works carried out in phase two were: the construction of dry stone foundations for the pillars in the porch (not existing before) (Fig. 8); the insertion of wooden tie beams (Ladakhi: *sket shing*) inside the porch wall (not existing before) (Fig. 18); the erection of new walls for the

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first floor room above the porch, the reconstruction of one of the lost wooden windows of the first floor based on a model of its symmetric window found on site, the new design and making of a wooden window frame with composite beam for the traditional Ladakhi balcony (*rab gsal*)[2] for the room on the first floor (based on similar examples of the same age in Nubra); the addition of a large dry stone staircase to access the building from the main terrace, and the reconstruction of a small stone stair for the porch. Phase two was successfully completed after the straightening of the two-storey structure (Fig. 19).

Fig. 19. Tilted structure with prop (left). The unpainted part of the beam marks the extent of the rotation of the column. The structure after it had been straightened (right).

Once the tilted structed was brought back to its original position, it was possible to complete the building with the roof on the main entrance and constructing the walls and ceiling of the room on the first floor above the porch. Phase three was the last stage, and involved the completion of the reconstruction process and most of the finishing works. This phase included: the reconstruction of the upper wall section on the Eastern side of the temple and its three windows; the complete reconstruction of the temple's roof with an appropriate slope (2%) for drainage. A waterproof sheet was added between the earth layers of the roof since nowadays roofs are not commonly maintained as they should. The damaged wooden beams were substituted and additional new beams were added to improve the overall strength of the horizontal structure. Water spouts made of local slate were also added since no gutters were previously inserted inside the parapet, causing water infiltration inside the temple's walls. The mud brick walls on the first floor around the chamber were reinforced with a double wooden tie beam and extra wooden columns in the corridor were added around these walls. In addition, a wooden skylight window was lifted and realigned, cracks in the mud brick walls were stitched, the parapets were rebuilt, and the outer and inner walls were replastered and white washed.

Fig. 20. View of the white-washed reconstructed porch and upper room with balcony (North-western side). Image credit: Javed Hanif architect.

Fig. 21. View of the white-washed reconstructed porch and upper room with balcony (North-eastern side). Image credit: Javed Hanif architect.

## 4. Conclusions: Considerations on the approach

Due to the very short time in which the project had to be planned out and executed, and the difficult conditions in which the team worked, most of the decisions were taken on site and problems were dealt with in a hands-on manner and almost exclusively without the use of architectural drawings. The temple was originally built by a group of non-expert volunteers from

[2] A large window paired with a balcony (Ferrari, 2021: 55).

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nearby villages and only by eye. For these reasons, the reconstruction was undertaken in a way that was visually harmonious with the existing building. Where possible, the newly constructed structural elements were improved. This meant decreasing the overlapping of vertical joints among stone courses, employing larger stones at the base of the walls and using longer stones at the corners, drastically reducing the amount of mud mortar where not necessary, and improving its cohesion qualities by mixing the local silty soil with higher quality clay coming from a nearby source by the river bank in the valley, and adding wooden tie beams to better distribute the loads within the masonry. Overall, the construction was almost completely carried out by hands, with minimal use of mechanical or electricity powered tools. This meant relying heavily on craft skills, or in some cases, challenging the team's knowledge and experimenting new empirical ways to resolve unexpected issues which constantly emerged onsite. In this case, the possibility of engaging with craftspeople that had inherited and were trained in a traditional knowledge system facilitated the conservation process (Diodati, 2016: 232). As Marchand (2008: 257) argues, creativity in many traditional building crafts centrally involves engagement in the physical 'making'. For this reason, the finished architecture unfolds in these processes, whereby the craftspeople are merged with the material object in a hands-on interaction over time. In this way, a building, like the tools used to make it, becomes the extension of the masons' unfolding idea.

Fig. 21. The terrace. Image credit: Javed Hanif architect.

Since this was the first time that the local administration secured funds for a conservation project, Achi members understood early on the importance of carrying out this work, not merely for the historical value of the temple, but as a way to exemplify what for Achi Association is a respectful conservation project. In this case, much attention was dedicated to solve irreversible structural issues by employing local materials and know-how. Moreover, team members were fully aware that even more recent buildings like the Dukhang Yokma (and not only very historically significant ones) should be given the rightful attention. This is necessary if a wider audience were to be engaged and made aware of the value of both tangible and intangible heritage, and thus on how to approach the unavoidable decay of local material objects. The project was not only aimed at the preservation of a historical structure, but also at the documentation of its oral history and at the valorisation of traditional craft skills through the conservation works process. This experience was crucial for demonstrating that it is possible to intervene even when time and material resources are very scarce and no current policies are in place for the preservation of cultural heritage.

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