"IS CONCRETE SOLUTION FOR ADOBE ARCHITECTURE? THE CASE OF LOMANTHANG_ MUSTANG"

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ABSTRACT

The Kingdom of Lo (Upper Mustang), located beyond the Dhaulagiri range in Nepal, is one of the most significant historic settlements of the Himalayas. Lo Manthang, the walled capital founded in the 15th century, remains an outstanding example of Himalayan vernacular architecture, with its rammed earth walls, adobe dwellings, palaces, monasteries, and chörtens. Historically, the region was a crucial corridor for trans-Himalayan trade with Tibet, shaping its cultural and economic identity. For centuries, isolation preserved its architectural authenticity and cultural traditions. In recent decades, however, modernization, tourism, and the introduction of road linkages have accelerated physical and cultural change. The increasing use of cement and concrete in conservation and new construction poses a serious threat to the structural integrity and authenticity of these adobe buildings. This study therefore investigates whether concrete is a viable material for conservation in Lo Manthang, using a qualitative methodology based on literature review, comparative case studies, and international charters. Guided by the Nara Document on Authenticity (1994) and Preservation Brief 5, the findings indicate that cement is unsuitable for adobe preservation due to its incompatibility with earthen structures, poor thermal performance, and symbolic detachment from traditional practices. Instead, the study emphasizes the use of vernacular materials—such as mud, lime, and timber—combined with traditional techniques to maintain authenticity and resilience. The research concludes that sustainable conservation requires not only technical interventions but also awareness programs, community training, and strict regulatory frameworks. Preserving Lo's heritage demands aligning traditional wisdom with modern conservation principles to safeguard its unique identity for future generations.

Keywords: Lomanthang, adobe architecture, preservation

Introduction

Mustang's northern region, Lo, is situated in the Kali Gandaki Valley, which for centuries served as one of the most significant trade routes between the Tibetan plateau and the lowlands of Nepal and India (Ramble, 1996). At its heart lies Lo Manthang, a historic walled settlement located in the Upper Mustang region of the Western Himalayas. This town sits at an altitude of about 3,750 meters in a small valley near the Nepal–Tibet border, embodying both the resilience of human habitation in high-altitude environments and the cultural interchange shaped by its geographic position. Historically, the area was first part of Tibet before evolving into an independent kingdom known as Lo (Chapagain, 2007).

Archaeological findings, including numerous caves carved into the cliffs, testify to human occupation in Mustang since around 2800 B.C. Buddhism spread into the region from Tibet during the 7th century A.D., leaving behind a rich religious legacy visible in monasteries, carved rocks, prayer flags, and chortens scattered across the landscape. Mustang remained under the Tibetan Kingdom until 1440, after which it became independent with Lo Manthang as its capital. In 1790, the Lo Kingdom was formally integrated into the Kingdom of Nepal (Richon, 2016). Despite this integration, Mustang retained a strong sense of cultural distinctiveness, rooted in Tibetan Buddhist traditions and the kingdom's semi-autonomous status.

Until the restoration of multiparty democracy in Nepal in 1990, Upper Mustang remained a restricted area. In 1992, the Nepalese government opened the region for controlled tourism, an event that significantly altered its trajectory. Management of tourism and conservation efforts in the area was entrusted to the Annapurna Conservation Area Project (ACAP), which had been launched in 1986 to balance natural resource conservation with development in the broader Annapurna region, including Upper Mustang (Chapagain, 2007).

The cultural identity of Mustang lies in its ability to thrive under harsh climatic conditions and in its deeply spiritual landscape. Religion permeates every aspect of life, symbolized through sacred architecture and markers such as prayer flags, chortens, and intricately carved stones (Richon, 2016). Within the ancient walled town of Lo Manthang, the royal palace, monasteries, and protective walls were historically constructed of rammed earth (ghyang), while ordinary residences were built primarily from sun-dried adobe bricks (paub) (Rawal et al., 2022). These traditional building techniques reflect not only the availability of local materials but also an architectural identity shaped by environmental adaptation and cultural expression.

For centuries, Mustang remained relatively isolated from the outside world due to its challenging terrain, allowing it to preserve a unique cultural character and architectural tradition largely untouched by external influences (Pradhan, 2021). However, this very isolation also left it vulnerable once modern forces began to penetrate the region.

In recent decades, the region has undergone profound transformations. The opening of Upper Mustang to tourism and the construction of a strategic national road have accelerated modernization (Lavie & Marshall, 2017). On one hand, these developments have brought economic opportunities, expanded trade, and facilitated cultural exchange with the outside world (Rawal et al., 2022). On the other, they have introduced new challenges for heritage preservation. Traditional livelihoods and practices have been increasingly influenced by modern lifestyles, and younger generations are often drawn to modernity, even while remaining

rooted in intangible cultural traditions such as festivals, rituals, and oral narratives (Richon, 2016).

This tension between preservation and modernization raises pressing questions about how best to conserve Mustang's historic adobe structures. Cement and concrete—widely perceived as durable, modern materials—have been increasingly used in conservation works. However, their compatibility with centuries-old adobe structures remains highly contested.

Against this backdrop, the primary aim of this paper is to critically evaluate whether cement and concrete are appropriate solutions for the conservation of Lo Manthang's 15th-century historic adobe structures. The study explores the broader implications of material choice on authenticity, sustainability, and long-term resilience of heritage architecture in Mustang.

The paper is organized into five sections: the introduction provides the outline and context of the study, along with the research aim and objectives, methodology explains the research approach, sources used, and the conceptual framework applied, literature review establishes the foundation for the study, highlighting why cement is unsuitable for preserving vernacular adobe structures, discussion interprets the literature review findings, examines the impacts of modernization, and suggests pathways for future conservation strategies and conclusion aligns the study's objectives with its findings, emphasizing the need to preserve authenticity through traditional materials and approaches.

Through this structure, the paper seeks to bridge historical context, conservation theory, and modern challenges to propose strategies for safeguarding the heritage of Lo Manthang in ways that honor both its cultural legacy and its living traditions.

Literature Review

This section consists of the review of the literature from the papers collected in this area of the study i.e. the site Kingdom of Mustang, Transition in Lomanthang and Impact of Modern Intervention.

Kingdom of Mustang

Mustang covers approximately 2,563 km² of high-altitude desert in the upper reaches of the Kali Gandaki River, close to the Tibetan border (Fig. 1). Once an independent Himalayan kingdom, Mustang was gradually consolidated under Nepalese rule while still retaining a significant degree of local autonomy—a characteristic that persists even today (Gurung & Decoursey, 1994).

Fig. 1: Upper Mustang Conservation and Development Project

The Upper Mustang, historically known as the Kingdom of Lo, is one of the most remote and isolated regions of Nepal. Until 1992, it was designated as a restricted demilitarized zone, a status that effectively shielded it from external influences for decades, making it one of the most preserved cultural landscapes in the world. Life in Upper Mustang traditionally revolved around pastoralism, limited agriculture, trade, and religious practices. For centuries, this valley acted as a critical corridor, linking India with Tibet and facilitating not only trade but also the flow of Buddhist ideas, art, and cultural exchanges.

Lo Manthang, the kingdom's walled capital founded in the 15th century A.D., remains the focal point of this heritage landscape. The settlement is home to a medieval palace and monasteries, two dating back to the 15th century and one to the 18th century. In 2008, the Nepalese government placed Lo Manthang on the Tentative List of UNESCO World Heritage Sites, recognizing its outstanding universal value (Richon, 2006). Upper Mustang's unique identity makes it an exceptional candidate for designation as a Cultural Landscape, as its settlements are scattered among monasteries, centuries-old fortresses (*dzong*), palaces, adobe dwellings, and cave complexes carved into cliffs. Many monasteries, with their deep cultural and religious history, remain among the most intact Tibetan Buddhist institutions anywhere in the Himalayas.

Historically, Mustang was part of the Trans-Himalayan salt trade route, a vibrant artery of commerce and culture. However, after the Chinese invasion of Tibet in the 1950s, the northern borders were sealed, and the area was declared restricted. Foreigners were only allowed entry in 1992 (Selter, 2007). Since then, scholars, conservationists, and tourists alike have turned their attention to this once-hidden kingdom, though much of its cultural fabric remains relatively under-studied (Rawal et al., 2022).

The cultural landscape of Mustang is visually and symbolically striking: flat roofs covered with juniper branches used for heating, strong winds unfurling prayer flags, bright barley fields bordered by pebble walls, and the chromatic harmony between earthen houses and surrounding red cliffs (Richon, 2006). This environment reflects both adaptation to a harsh climate and a deeply spiritual connection to place. Despite some earlier restoration projects, detailed architectural drawings of Lo Manthang remain scarce, underscoring the need for further systematic documentation.

Transition in Lo Manthang

Until the 1960s, Lo Manthang retained its medieval character almost intact (Richon, 2006). The fortified earthen wall encircling the city functioned not only as a

defensive structure but also as a cultural and religious boundary. Traditionally, residents were required to live within its perimeter, and the gates were closed at night to protect both people and livestock from invaders and harsh winter winds (Selter, 2007). Symbolically, the wall delineated the sacred city from the outside world, often perceived as a realm of chaos or demons. Today, however, the wall is more of a symbolic relic of tradition than a functional defense system (Richon, 2016).

The construction of a sand-and-gravel road in recent decades has accelerated modernization and urban expansion. Traffic and trade have increased, and new buildings—particularly lodges, restaurants, and shops catering to tourism—have emerged outside the walls. To ease mobility, additional openings have been made in the historic wall, inadvertently weakening its structure (Rawal et al., 2022).

The Lo Manthang Palace, together with its intact urban fabric, remains an extraordinary monument of Tibetan-inspired Himalayan architecture. Founded in 1441, it marked the kingdom's consolidation under a new ruler, who moved from Tsarang to oversee the creation of this fortified capital (Rawal et al., 2022). Traditional buildings were constructed from locally available mud, stone, and timber, harmonizing with their environment. Courtyard houses provided insulation, and compact settlement patterns offered protection against winds. Yet today, the growing availability of new construction techniques and materials—primarily cement and timber—is reshaping the built environment. As modern values take precedence, whitewashed adobe houses are increasingly replaced by cement-based structures, slowly altering the unique identity of Mustang (Pokharel, 2002; Wegner, 2020).

The skyline and visual character of Lo Manthang are also being transformed. Buildings constructed outside the historic walls threaten the visual integrity of the landscape, including the iconic view from the passes overlooking the walled city. Trucks now drive and park dangerously close to fragile chörtens, endangering their stability. In 2016, a luxury concrete hotel was built on the plateau; though designed to mimic traditional architecture, its height exceeded traditional volumes, disrupting the town's proportional balance (Richon, 2016).

Impact of Modern Interventions

Tourism has been both a boon and a challenge for Lo Manthang. It has created economic opportunities but has also accelerated cultural and architectural change (Regmi, 2014). A particularly concerning development is the widespread use of cement imported from China for repairs. In Lo Manthang's environment, cement is technically unsuitable: it cracks and deteriorates rapidly due to extreme temperature variations between day and night and between seasons. It also offers

poor thermal insulation compared to mud-based materials. Despite these limitations, cement is popular because of its symbolic association with wealth and modernity. Transported at great expense over rugged terrain, it has become a luxury good and a visible marker of social status (Richon, 2016). Cement now appears in doorsteps, window frames, walls, and even minor repairs across the town.

Another factor undermining traditional practices is the decline of skilled craftsmanship. Traditional earthen construction techniques require specialized knowledge and collective labor, but younger generations increasingly migrate to cities or abroad for education and employment. Construction is often carried out by workers from lower regions, who are unfamiliar with Mustang's traditional methods (Rawal et al., 2022). This, coupled with the improved availability of industrial materials from Pokhara and other cities, has fueled the preference for cement and stone, which are perceived as stronger, more durable, and less labor-intensive.

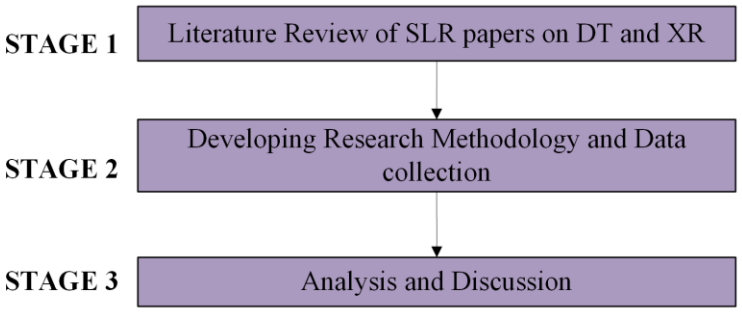
However, these perceptions are misleading. While cement may initially appear more permanent, it is not adapted to Mustang's climate. Earthen materials are thermally superior, providing insulation and comfort, whereas cement-based structures often become cold in winter and overheated in summer. Already, hybrid structures are appearing: concrete pillars with adobe infill walls, or roofs combining cement, pebbles, timber, and even polythene sheets after the 2015 earthquake (Richon, 2016). Without standardization, proper guidelines, or trained professionals in earthen architecture, this patchwork approach further erodes both the authenticity and resilience of the built environment.

Finally, the rise of aesthetic misconceptions has influenced construction practices. In local perception, straight lines, sharp angles, and smooth cement finishes signify modernity and prosperity, while irregular, organic adobe forms are associated with poverty or backwardness. This shift in cultural values has accelerated the replacement of traditional architecture, even though traditional materials are locally available and environmentally appropriate. Meanwhile, timber—once integral to construction—has become prohibitively expensive, leading to minimal use.

Methodology

This study adopted a qualitative approach, drawing primarily on secondary sources and previous research. ResearchGate and Google Scholar served as the main repositories for retrieving literature, while additional historical and international references were incorporated to provide context. An overview of this process is shown in Figure 2.

Stage One: Literature Review



The first stage consisted of a **background study** through an extensive review of literature on **Upper Mustang**, **modern interventions**, and the **transitions within Lo Manthang**. A total of **19 papers** were reviewed, most of which addressed the impacts of modernization on Lo's cultural and architectural heritage. This stage established the foundation of the study and identified knowledge gaps regarding material use in heritage preservation.

Stage Two: Methodology Development and Data Collection

The second stage involved refining the methodology and gathering relevant data. Papers were retrieved mainly from **ResearchGate** and **Google Scholar** using the keywords *"CONCRETE," "HERITAGE," "LOMANTHANG,"* and *"UPPER MUSTANG."* Given the small number of results, all retrieved papers were included in the study. To strengthen contextual understanding, the history of the **Kingdom of Mustang** and several **international charters**—such as the **Nara Document on Authenticity**—were also reviewed. These sources provided insights into the challenges of using modern materials and the value of vernacular alternatives in conservation.

Stage Three: Analysis and Discussion

The third stage centered on analyzing the literature review findings. The discussion emphasized the importance of vernacular materials such as mud, stone, and timber in maintaining the authenticity and sustainability of Lo's heritage structures. At the same time, it critically examined the consequences of modernization, particularly the use of concrete, which undermines both structural compatibility and cultural authenticity. Insights from international charters were incorporated to frame recommendations for preservation strategies that respect Lo's cultural identity while addressing the realities of change.

Discussion

This section discusses the Literature review based on various themes i.e. 1) Authenticity and the use of traditional materials n heritage conservation 2) Preservation of Adobe Structure 3) Nepalese context and legal frameworks 4) Awareness, Community Engagement, and Adaptive Reuse and 5) Documentation and Intergenerational Transmission.

1) Authenticity and Traditional Materials in Heritage Conservation

The Nara Document on Authenticity (1994) has been a cornerstone in guiding international debates on the conservation of cultural heritage. It stresses that the safeguarding of heritage in all its forms and across all historical periods must be rooted in the values attributed to that heritage by the communities concerned. In this sense, authenticity is not a fixed or universal concept; rather, it is interpreted within the framework of each culture's unique traditions, values, and historical experiences. Recognition must therefore be accorded to the specific nature of heritage values within a given cultural context, and the credibility and truthfulness of related sources of information must be carefully evaluated.

The Nara Document further clarifies that judgments of authenticity may draw upon a wide range of sources depending on the type of cultural heritage, its cultural environment, and its evolution over time. These sources include not only material and physical aspects—such as *form and design, materials and substance, and use and function*—but also intangible and contextual elements such as *traditions and techniques, location and setting, spirit and feeling, and other internal and external factors*. In other words, authenticity is multifaceted, encompassing tangible attributes alongside intangible cultural dimensions that define the identity and meaning of heritage sites. This framework compels heritage practitioners to adopt a holistic approach to conservation that extends beyond technical interventions, embedding conservation practices in cultural, spiritual, and social realities.

2) Conservation of Adobe Structures: Lessons from Preservation Brief 5

Adobe architecture represents one of the oldest and most widespread forms of earthen construction, deeply embedded in the traditions of many cultures, including Nepal. Preservation Brief 5, published by the U.S. National Park Service, provides critical guidance on adobe conservation and restoration. The brief notes that adobe structures, by their very nature, deteriorate over time due to weathering, erosion, and structural vulnerabilities. However, this deterioration should not be viewed as a failure but as an inherent quality of earthen materials.

Once structural stabilization has been carried out, the restoration of adobe buildings must prioritize the use of traditional or original materials. Damaged or

missing elements should be repaired or replaced with materials that closely match the original in composition, color, and texture. This attention to authenticity ensures that the repaired sections integrate seamlessly with the historic fabric. A critical warning issued in Preservation Brief 5 is the inappropriateness of Portland cement or lime mortar in adobe repair. These modern mortars are significantly harder and have different thermal expansion properties compared to adobe bricks. As adobe walls expand and contract due to temperature changes, rigid cement mortars fail to adapt, transferring stress back onto the weaker adobe bricks. This mismatch causes the bricks to crack, crumble, and ultimately disintegrate.

Thus, the preservation of adobe requires three interlinked understandings:

1. Acceptance of adobe's natural deterioration – acknowledging that adobe, being an earthen material, is vulnerable but can still be maintained with proper care.
2. Recognition of the building as a system – repairs must consider the structure holistically, rather than treating damaged parts in isolation.
3. Awareness of natural forces – conservation must account for weather, moisture, seismic risks, and other environmental conditions that continually act upon adobe structures.

Preservation Brief 5 ultimately reminds us that adobe preservation is not about making the material artificially permanent, but about maintaining a continuous cycle of repair and care using materials and methods that respect its traditional nature.

3) Nepalese Context: Policy, Law, and Practice

In Nepal, the Ancient Monument Preservation Act of 1956 provides the primary legislative framework for heritage protection. Together with international charters such as the Nara Document, the Venice Charter (1964), and the Burra Charter (1979), it establishes the principle that traditional materials and techniques must guide conservation efforts. As Dawadi (2018) highlights, heritage reconstruction in Nepal requires strict adherence to authenticity, not only in physical form but also in spirit and cultural expression.

The case of Lo Manthang in Upper Mustang illustrates the challenges of aligning these ideals with modern pressures. Increased connectivity through road networks, the introduction of cement-based construction, and changing community needs have often disrupted the continuity of traditional building practices. In many cases, cement has been embraced as a modern and "stronger" material, but its long-term effects on earthen structures have been damaging. These trends underline the urgent need for clear policies that encourage traditional conservation practices, regulate incompatible construction techniques, and ensure that high-quality traditional materials remain accessible in the market.

Equally, heritage-sensitive policies must move beyond regulation to active support systems:

- Material supply chains – ensuring adobe, timber, and other vernacular materials are produced, distributed, and accessible.
- Capacity building – training new generations of masons and artisans in traditional construction techniques.
- Incentive mechanisms – offering subsidies, tax breaks, or grants for owners who use traditional techniques in repairs and construction.

Only through such systemic measures can conservation practices become both sustainable and culturally relevant in Nepal's rapidly modernizing environment.

4) Awareness, Community Participation, and Adaptive Reuse

According to Richon, awareness-raising initiatives are critical for shifting public perception. Many communities view cement and concrete as symbols of progress and permanence, without realizing their long-term incompatibility with earthen heritage structures. Educational programs and demonstration projects can help communities understand that traditional architecture is not only more sustainable but also better adapted to seismic conditions and climatic variations. Such campaigns can instill pride in traditional craftsmanship while promoting conservation as a forward-looking, rather than backward-looking, endeavor.

At the same time, adaptive reuse presents an innovative solution to reconcile conservation with modern needs. Old adobe houses, many of which are abandoned or underutilized, can be rehabilitated into guesthouses, community spaces, or cultural centers. By integrating heritage structures into the tourism economy, adaptive reuse reinforces local pride, creates economic opportunities, and ensures that conservation becomes a source of livelihood rather than a financial burden.

Furthermore, adaptive reuse aligns with global sustainability goals by minimizing new construction, reducing carbon footprints, and promoting circularity in building materials. In Nepal's context, where tourism is a major economic driver, adaptive reuse can play a transformative role in both heritage conservation and community development.

5) Documentation and Intergenerational Transmission

As Regmi emphasizes, documentation is an indispensable tool for heritage conservation. Recording tangible elements—such as building layouts, materials, and construction details—as well as intangible aspects like rituals, techniques, and oral histories ensures that future generations inherit not only the physical structures but also the knowledge systems that sustain them. With the increasing threats of modernization, climate change, and seismic risks, comprehensive documentation serves as both a safeguard and a foundation for resilience.

Equally important is the intergenerational transmission of skills and values. Without deliberate efforts to train young craftsmen in traditional techniques, knowledge risks being lost. Apprenticeship programs, heritage schools, and community workshops can create pathways for sustaining traditional construction knowledge while adapting it to contemporary contexts.

Conclusion

Lo Manthang, the walled capital of the former Kingdom of Lo in Mustang District, stands as one of the most remarkable cultural landscapes of the trans-Himalayas bordering Tibet (Rawal et al., 2022). Its geographical isolation, dramatic landscapes, and centuries of adaptation to a harsh environment have given rise to a cultural and architectural tradition that is both humble and resilient. Unlike the monumental or iconic architecture of urban centers, Lo Manthang embodies a form of vernacular architecture rooted in necessity, spirituality, and harmony with the surrounding landscape (Pradhan, 2021). Its rammed earth walls, adobe houses, monasteries, and palaces together create an urban fabric that is deeply connected to local values and practices.

Yet, this fragile heritage now faces unprecedented challenges. Modern interventions, such as the construction of new roads and the increasing use of cement and concrete, have begun to alter both the material fabric and the intangible essence of Lo Manthang. These materials, often perceived as symbols of modernity and strength, are in fact unsustainable in the local climate. They deteriorate rapidly due to extreme temperature fluctuations between day and night, and they undermine the thermal efficiency and structural balance of traditional adobe buildings. More importantly, their use erodes the authenticity of the town, placing not only its physical structures but also its cultural identity at risk.

International conservation guidelines such as the Nara Document on Authenticity (1994) and the Preservation Brief 5 emphasize that authenticity is best preserved through the continued use of traditional materials and techniques. Mud, lime, stone, and timber—when combined with indigenous construction knowledge—offer both technical suitability and cultural continuity. Therefore, conservation strategies for Lo Manthang must prioritize the repair, restoration, and maintenance of heritage structures using these vernacular methods.

However, technical interventions alone are not enough. Long-term preservation requires community involvement and awareness. Awareness programs should be implemented to educate residents about the dangers of inappropriate modern materials and to encourage pride in traditional building practices. Such programs could also highlight the broader value of Lo Manthang as a unique cultural heritage

site of global importance, reinforcing the idea that its preservation benefits both local communities and humanity at large.

Also, the documentation of heritage structures—through drawings, photographs, digital models, and archives—must be prioritized. Documentation ensures that even if structures are damaged by natural disasters, modernization, or neglect, a comprehensive record of their form and cultural significance will be preserved for future generations. In this sense, digital preservation becomes a parallel form of safeguarding, complementing physical conservation.

In conclusion, the preservation of Lo Manthang requires a balanced approach: one that respects its traditions while addressing the realities of modern pressures. By strengthening legal frameworks, promoting traditional construction practices, raising community awareness, and systematically documenting its heritage, the authenticity and cultural spirit of Lo Manthang can be safeguarded. Preserving this breathtaking settlement is not merely about protecting buildings—it is about sustaining a cultural identity, a way of life, and a unique testimony of Himalayan civilization for generations to come.

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