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HERITAGE CONSERVATION IN INDIA: CHALLGENGES AND NEW PARADIGMS

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Abstract. *Conservation of heritage structures is an interdisciplinary effort, wherein traditional knowledge on building materials, techniques and specifications are brought to the realm of current practitioners of conservation engineering, with the intent of merging them with modern tools and practices. Internationally, it is established practice that structural safety cannot be compromised in any conservation effort. Formal systems that recognise conservation of heritage structures as an interdisciplinary engineering effort, with structural safety as a critical determinant, do not exist in India. With one of the largest stocks of heritage structures in the world, lack of adequate quality and quantity of manpower is a serious bottleneck in India in addressing the task of understanding and protecting heritage structures from natural hazards, ageing and weathering effects. More importantly, in a country with strong spiritual roots, the approach to conservation of built heritage has to explore the basis of the ancient building system, the centrality of the spirit in the building activity and the philosophy of non-permanence of the material. Such an approach may be in contrast to established, internationally accepted approaches to conservation.*

Hence, capacity building in structural safety-centric conservation engineering is a major challenge for India, with an urgent need to identify the existing diffused expertise in relevant sub-areas within conservation and forming a consortium for a holistic approach to the national grand challenge of protecting heritage structures. To achieve the intended goal, a national knowledge pool has to be developed by initiating concerted research, education and outreach activities in safety of heritage structures, coordinated and organised through a single national level institute, that can provide the much needed nationally-coordinated technical forum for exchange of ideas and training of stakeholder groups, primarily from implementing agencies (e.g. Archaeological Survey of India, State Archaeology Departments, etc.) and faculty members of engineering and architecture institutes. As a step to address the national need, IIT Madras is leading an effort to begin a formal approach to address safety of heritage structures through the National Centre for Safety of Heritage Structures (NCSHS). The current paper dwells on the challenges and the need for developing new paradigms in the heritage conservation scenario in India.

1 INTRODUCTION

The Indian sub-continent is endowed with, perhaps, the richest and the most diverse stock of cultural and architectural heritage, with a significant proportion of them constituting living monuments. India has an overwhelming number of heritage structures, of which the protected ones include barely 25 edifices declared as World Heritage Monuments by UNESCO, approximately 3,650 monuments in the custody of Archaeological Survey of India (ASI) declared as monuments of national importance. Several thousand are in the custody of religious endowments and Archaeology Departments under state governments, and tens of thousands more heritage structures do not come under any formal system due to lack of infrastructure and funds. These unprotected monuments and heritage structures are brought to public notice and protected mainly due to the intervention of Non-Governmental Organisations (NGOs), such as Indian National Trust for Art and Cultural Heritage (INTACH). Traditional construction materials and practices are still used in renovation of heritage structures with the involvement of traditional artisans and masons, however, not so widely in construction of new buildings.

With new doctrines of heritage conservation, evolved in Europe and elsewhere (e.g. the Venice Charter, 1964, the ICOMOS Charter, 2003, etc.) through centuries of debate among primary stakeholders, being deliberated and applied internationally, a unified global character to heritage conservation is inevitable. And such common minimum acceptable norms are essential, as we must see ourselves only as custodians of the rich cultural heritage of humanity, which belongs to the entire world, and not just nations protecting their heritage. A fundamental question, especially in the Indian context, which may also be extended to a larger Asian or eastern context, is what is the focus of conservation: is it the structure and the materials that compose it, and the history of a civilization that lies encoded in the choice of materials and construction practice or is it the spirit of a place that the structure was built with the intention of capturing? The answer to the question could possibly give us an insight into what is that one needs to conserve. The current paper attempts to gauge the scenario of heritage conservation in India, elucidating the challenges and exploring possible paradigms for a more holistic approach to heritage conservation in India.

2 VULNERABILITY OF HERITAGE STRUCTURES IN INDIA

Heritage structures often require remedial interventions due to material deterioration and structural distress caused by natural phenomena, such as, ageing or weathering of materials, and natural and man-made disasters. They were built in an era when building codes, as we know them today, were not formalised, and with construction materials and techniques that present-day engineers and architects are neither acquainted with, nor formally taught. The durability of these structures may offer an illusion of eternity. Conversely, time is working against the stability of such structures with a mechanism of continuous strength reduction. They exhibit augmented vulnerability to natural disasters, such as, earthquakes, floods and cyclones. Hence, there is a persistent danger of losing a large stock of heritage structures to natural calamity. This vulnerability holds even under man-made disasters, including vandalism and pollution.

The performance of heritage structures during the 2001 Bhuj earthquake can be seen as a case in point. The Kutch district, continuously inhabited since the Indus Valley civilization, is home to 250 heritage towns and villages with more than 15,000 heritage properties. It was estimated that during this earthquake, about 10,000 heritage structures were either destroyed or extensively damaged [Gupta et al., 2001]. Although earthquakes have repeatedly occurred in the area, e.g., 1819 Allah Bund Earthquake and 1956 Anjaar Earthquake, seismic safety of historical construction has not been addressed. Some architectural systems (e.g., arches and

domes) are used extensively in earthquake-prone areas, which are known to be vulnerable. Interventions are required for the conservation and continued use of these heritage structures. The recent moderate Sikkim earthquake in 2011 demonstrated the need for urgent interventions to protect the fragile stock of Buddhist monasteries, most of which are built with random rubble masonry, notorious for their seismic vulnerability, despite being a high seismic zone [Menon and Murty, 2012]. Guidelines are required for restoration and seismic strengthening of heritage structures to ensure their protection in the long run are urgently required [Mathews and Menon, 2008]. The map of the 25 World Heritage Monuments in India, superposed on the seismic zoning map of the country does not present a comforting picture (see Fig. 1). In a landmark move, the recent document on the National Conservation Policy (ASI, 2014) has explicitly included a requirement that all conservation efforts at any monument should be accompanied by a disaster management plan. Necessary steps are required to be initiated (a) to ensure effective post-disaster management, (b) to ensure adequate preparedness, and (c) to carry out appropriate scientific assessment of existing risks and to undertake mitigation measures by retrofit, where warranted.

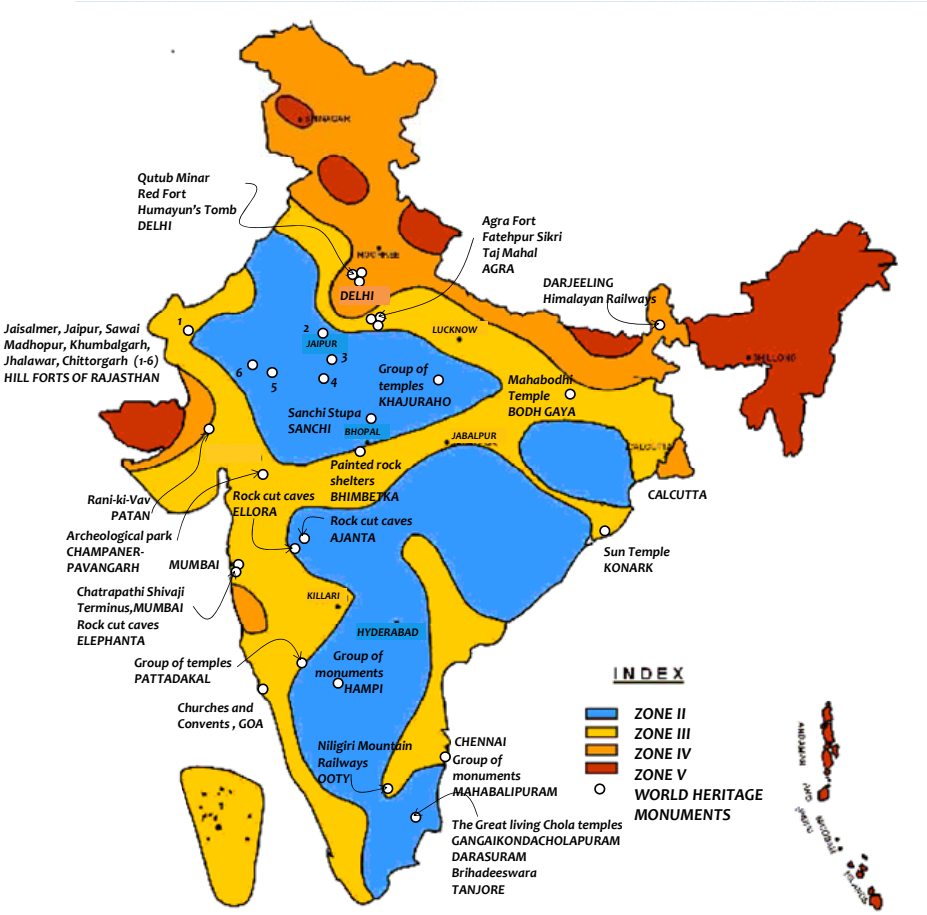

Figure 1: World heritage monuments superposed on the Indian seismic zoning map (IS 1893: 1, 2002)

The available knowledge on structural behaviour of historical Indian structures is limited. While significant effort has been dedicated to documenting historical monuments in India, by both Indian and international researchers, their focus has customarily been architectural documentation, e.g., Monograph on Heritage buildings in Thiruvananthapuram, and Domes and

Vaults of South India, published by Indian National Academy of Engineering (INAE). Besides, there are typical challenges in studying historical structures, particularly vis-à-vis application of modern engineering practice. Geometry of the monuments is seldom available. Characterisation of mechanical properties of historical construction materials is complicated by large variability in mechanical properties, attributable to workmanship and use of natural materials. Changes in behaviour of structural elements are expected due to long duration of construction and unknown construction sequences. Existing damage and material deterioration in the structures have to be investigated, and direct application of standards meant for new constructions may not be warranted.

(a)

(b)

Figure 2: (a) Collapsed 19th c. AD Rao Lakha Chattri in Bhuj (January 2001); (b) Severely damaged 17th c. AD Ringin Monastery in Mangan, Sikkim (September, 2011)

3 HERITAGE SAFETY EDUCATION IN INDIA

Conservation of heritage structures is an interdisciplinary effort, wherein traditional practices and knowledge on materials, construction and specifications are brought to the realm of current practitioners of conservation engineering, with intent to merge them into the modern tools and construction practices. Internationally, it is established practice that safety of heritage structures cannot be compromised in any conservation effort [ICOMOS, 2003].

Over the last 150 years, Archaeological Survey of India (ASI) has done detailed work on conservation of heritage structures, monuments and sites in India. But, the Science Branch of ASI, established in 1917, focuses primarily on chemical treatment and preservation. Occasional collaborations between academia and ASI (e.g., Ta Prohm Temple Conservation Project, Cambodia) are testimony to the need and potential successful collaboration between specialists with diverse backgrounds to come together in complex projects. The Institute of Archaeology established in 1985 (formerly School of Archaeology, established in 1959) offers a two-year PG diploma course in Archaeology. But, the course on structural conservation of monuments in their curriculum is not structural-safety centric. India needs to develop formal systems that recognise conservation of heritage structures as an interdisciplinary effort with structural safety as one of the critical determinants in any conservation project. There is a need to benchmark the Indian practice with international state-of-the-art and state-of-the-practice of conservation engineering. Detailed investigations on structural behaviour of heritage structures, with use of state-of-the-art scientific tools for condition assessment, structural analysis, repair and strengthening [Binda et al., 1999] are required to improve the state-of-the-practice of conservation engineering in India.

Modern-day practitioners (engineers and architects) in India, typically trained in modern materials and practices of construction, do not seem to appreciate the rationale behind the use of specific traditional building materials and practices. The undergraduate engineering and architecture curricula currently adopted in India, with very few exceptions, have no pedagogical content on ancient Indian construction materials and methods. Academic courses on conservation, typically offered in architecture schools, are bereft of the structural safety angle. Academic courses in civil engineering schools have progressively overlooked structural behaviour of masonry and timber, predominant construction materials of our heritage structures. This brings us to a situation where the country faces a near-total lack of expertise in structural-safety centric conservation engineering. With only 25 edifices listed as World Heritage Monuments by UNESCO, about 3,650 to be protected by national agencies, several thousand to be protected by state-level agencies, and many more unlisted and unprotected, the task of capacity building in the area of structural safety of historical monuments in India is onerous.

Convergence of scientific reasoning and traditional wisdom through pedagogic transformation holds the key to preservation of Indian heritage. Interdisciplinary scientific research of Indian heritage is vital in achieving social relevance of heritage protection, which in turn can spawn new R&D and business opportunities in technological frontiers, such as material science, diagnosis and structural rehabilitation in India.

4 GAPS IN ENSURING SAFETY OF HERITAGE STRUCTURES IN INDIA

Before we address a more profound interpretation of heritage conservation in India, from a practical standpoint, the current state of affairs is already challenging on a number of fronts.

(1) The national and state agencies hold a limited number of heritage structures in their custody, but do not have initiatives to ensure their long-term safety, even though they are responsible for safeguarding these heritage structures. Limited trained manpower in structural safety and limited infrastructure, particularly of experimental and numerical facilities are possible reasons for not undertaking the necessary research and development in structural safety.

(2) Heritage conservation efforts in the private sector in India largely address only the aesthetic aspect with architects typically steering these projects; safety of the heritage structures is absent in most of these efforts, owing to lack of participation of engineers in such projects and even availability of suitably trained engineers competent to address the special challenges of heritage structures. Since structural safety is not in focus, no quantitative approach is noted in these projects from the standpoint of structural safety.

(3) Conservation of heritage structures is an interdisciplinary engineering effort, with structural safety as one critical determinant, and not just a matter of aesthetics and architecture. Formal systems are absent in India, which recognise the need for use of scientific tools for diagnosis and quantitative assessment of residual capacity before choosing repair or strengthening strategy.

(4) There is lack of convergence between modern-day engineering education and traditional knowledge of construction materials and practices; this is a serious hindrance to preservation of heritage.

(5) The current practices of post-disaster interventions in heritage structures can at best be termed as repair, which often are unscientific, ad hoc, and semi- or non-engineered. Retrofit or pre-disaster intervention is desirable, but requires a comprehensive programme. Important facets of conservation, like reversibility of the chosen intervention and documentation of the intervention undertaken, are accepted as part of process in

international practice; such an approach is yet to be internalised in the national and state agencies undertaking post-disaster interventions.

(6) India has a large stock of heritage structures, which has to be addressed through a formal platform focussing on their structural safety. But, lack of adequate quality and quantity of manpower is a serious bottleneck in India to address the gigantic task of understanding and protecting the large number of heritage structures from natural hazards. The current number of specialists and trained personnel available for undertaking conservation engineering in India is insufficient. In this context, the recent National Conservation Policy (ASI, 2014) requirement that systematically, all monuments of national importance be scientifically assessed and retrofitted, where warranted, faces a serious hurdle due to shortage of skilled manpower in the area. Thus, capacity building in conservation engineering is a major challenge for India, and current efforts to build capacity in conservation engineering are too few and not organised. Even the isolated efforts of research in heritage structures fail to provide useful and implementable deliverables, indicating clear disconnect between academic institutes and implementing agencies.

5 UNDERSTANDING THE BASIS OF ANCIENT BUILDING SYSTEM OF INDIA

5.1 The centrality of Spirit in the practice of building

According to Vedic philosophy, the physical body of every being is itself a temple, and the soul dwelling within it is the subtle body or vital energy, which is the manifestation of the Supreme Being thus implying that every being is a mobile temple. On the other hand, all built forms are considered to be embodied energies, hence living organisms. *Sthapatya Veda* (or *Vaastu Veda*), an ancient treatise that deals with architecture of buildings and temples, elucidates the central concept of building, that is the engagement with energy (*Vastu*) and matter (*Vaastu*). The former is the free and unfettered energy (*Purusha*), whereas *Vaastu* is the embodied energy (*Vaastu Purusha*), representing the material spatial form. The aim of *Vaastu Shastras*, or the science of *Vaastu*, is to bring physical, mental and spiritual well-being for all. *Varahamihira* in *Brihat Samhita* notes (in Sanskrit) "*Vāstu shāstram pravakshyāmi lokānām hita kamyayā*": I expound *Vaastu Shastra* for the welfare of human beings and fulfilment of their desires. In the words of Ganapathy Sthapati [2005], "it was a self enquiry focussed on inner phenomena and replication of the inner experience onto the outer world of reality."

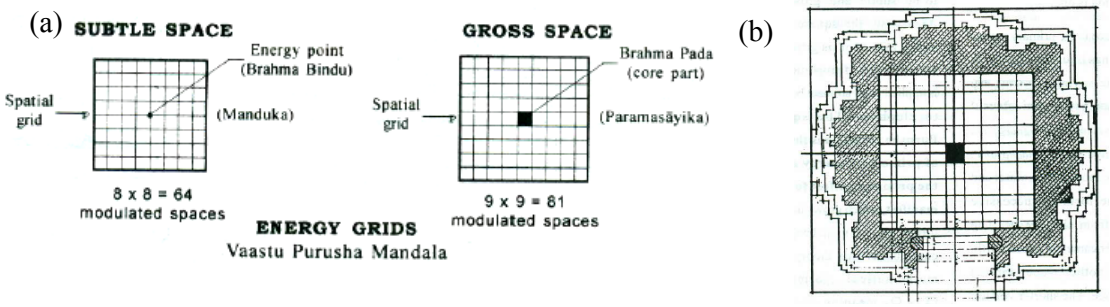

Figure 3: (a) The Mandala and (b) Sanctum Sanctorum (Ganapathy Sthapati, 2005)

The structure is conceived as a living organism with active functions of the four gross elements: air, fire, water and earth at the corner zones with the primal element of space (or energy) at the centre. The space so enclosed is packed with three more elements, namely, sound,

light and pulse. The five gross elements and the latter together form the eight elements that every animate being is composed of. *Vastu* (the energy) metamorphoses into *Vaastu*, embodied energy or embodied spatial form, with the luminous space being the source of all animate objects. The temple is considered not as the home of God, but the form of God; the temple structure is realised as the body, and the space contained within, the spirit. The *Skandopanishad* notes (in Sanskrit): *"Devo devālayah prokto jivo devah sanātanah*": The body is the *Alaya*, dwelling place, and the *Jiva*, which dwells in the body is the Supreme Being).

The concept of a temple structure as the extended material of the *Jiva* is described in technical language to aid designing of temple forms. The layout of the temple or a residential building is synonymous with the layout of the cosmos. The layout is a grid of 8 x 8 (64 spaces) or 9 x 9 (81 spaces) called *Mandala* (see Fig. 3a). This geometry forms the basis of the replication of the subtle substance of the universe into visual material form, two-dimensionally, as a square and three-dimensionally, as a cube. One such cubical space dwells in the cave of our heart and in the hearts of all animate objects of the universe. This cube with a square base is called *Vaastu Purusha Mandala* (see Fig. 4), representing the micro-univers, which is one with the macro (According to the Veda: *Anoraniyān mahato mahiyān*: The qualities of the atom: *anu* and the cosmos are the same, because both have originated from the luminous space that surrounds the earth and every object of the universe).

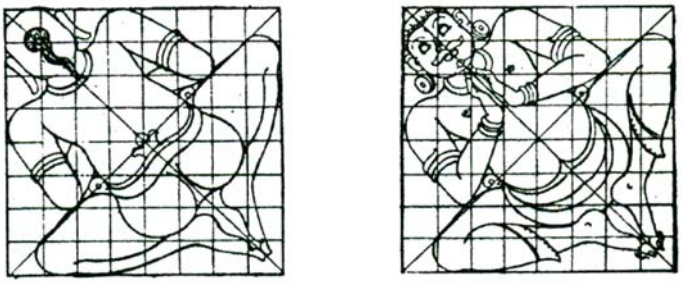

Figure 4: The Vaastu Purusha Mandala (Ganapathy Sthapati, 2005)

Time (or *Kālam*) causes the existence of all objects of nature. Time-dependent vibrations are the root of all phenomena, a concept extended to poetry, music and dance, where *Kālam* is re-designated as *Tālam*. The *tāla* measure is also extended to the building (house or temple) and even sculpture. The sanctum is understood to be a living organism capable of vibrating from within and spreading into a space of energetic particles. The *garba griha* (sanctum sanctorum or the foetus of space containing the space-atom: see Fig. 3b) is designed in terms of frequency of vibrations, with energy waves emanating from within produce positive effects in the human psyche just as music would, and this structural vitality is what one feels when entering the temple. If a part of the vast space is isolated and bounded by a four-walled structure, the building becomes a living organism and starts pulsating from within, like a human being. Harmony is created between human vibrations and vibrations emanating from a building by mathematical calculations for the dimensions and the proportions of the built form.

Several *Agamas* and *Vaastu Shastras* identify various parts of the temple structure as the symbolic representation of various limbs of the God, either in standing or seated posture. See Fig. 5 and 6.

Quoting from *Viswakarma Vaastu Shastra* (in Sanskrit):

Upapītam caranākāram adhistānam jānumandalam samāgam

Kumbhapañjara samsthānam nābhi ca udara samāgam pādavargam karākāram

Prastaram bhūmūlakam tat khantam galamityuktam

Sikharam mukhameva ca usnīsāntam sikhā caiva mahanasi ca nāsikā
Netrānām kshudranāsyau ca visvarūpamiti smrtam

The above translates into: The ornamental plinth of the temple represents the holy feet of the God and the stool supporting them; The thighs and knees are represented by the *Adhishthanam*; Torso with the hands of the God is represented by the walls covering the Sanctum Sanctorum (*Padavargam*); The bold ornament resembling the *Purna Kumbham*, embedded in the *Padavargam* symbolise the stomach and navel; The cornice capping the *Padavargam* represents the shoulders; The *kantham* (below the *Shikara*) symbolises the neck; The *Shikara* represents the face and top of the head of the God; The Buddhist Sun window on the *Shikara* represents the nose, and the eyes are represented by lotus-like ornaments on either sides of the windows [extracted from Reddy, 2010].

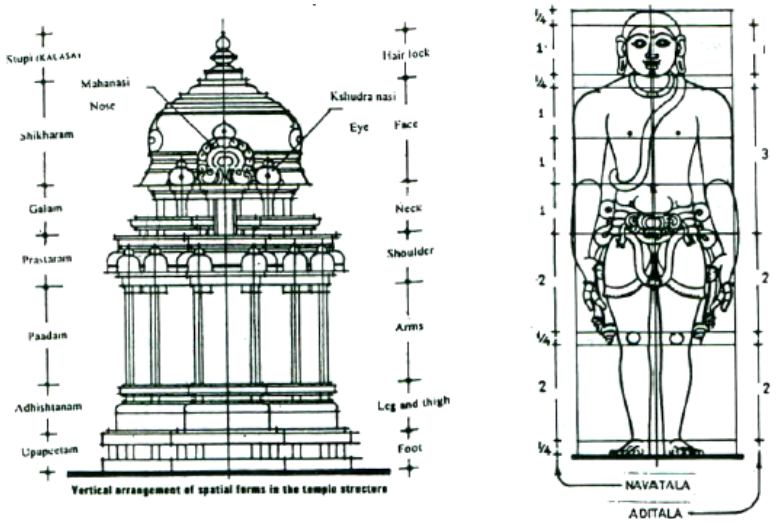

Figure 5: Vertical arrangement of spatial forms in the temple and its relation to the human form (Ganapathy Sthapati, 2005)

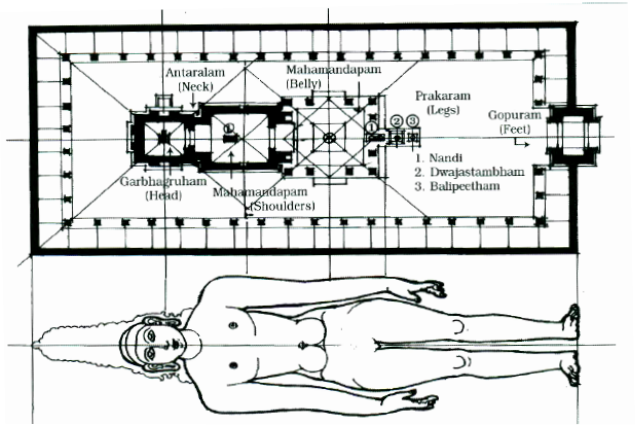

Figure 6: The temple and its relation to the human form in plan (Reddy, 2010)

5.2 Concept of *jeernodharana* and the philosophy of non-permanence of material

From the above discussion, that spirit was at the centre of the activity of building in ancient India, be it a temple or a residential building, becomes adequately clear. In the words of Sri Aurobindo (1920) who talked about the need for an Indian renaissance for a return to her

roots in today's context, spirituality is indeed the master-key of the Indian mind, and the sense of the infinite is native to it. "She was alive to the greatness of material laws and forces; she had a keen eye for the importance of physical sciences; she knew how to organise the arts of ordinary life. But she saw that the physical does not get its full sense until it stands in right relation to the supra-physical; she saw that the complexity of the universe could not be explained in the present terms of man or seen by his superficial sight, that there were other powers behind, other powers within man itself of which he is normally unaware, that he is conscious of only a small part of himself, that the invisible always surrounds the visible, the supra-sensible the sensible, even as infinity surrounds the finite."

It is unambiguous how the "spirit of a place" holds primacy over the material that constitutes it, and the latter is only a tool to express the former. With the analogy of the building to a living organism, it is only natural that buildings age or weather over time and that a need for renewal of the external "shell" is felt. A renewed "shell" performs its function of holder of the spirit more effectively. In the ancient building tradition, *Jeernodharana* is restoration or renovation, or repairing what is ruined (the concept finds mention in INTACH's Charter of 2004). Interestingly, during the process of *Jeernodharana* in temples, it is believed that the original shrine is no longer functional, and *Balayalam*, a miniature temporary structure is erected during the renovation and the purification ceremony, the latter known as *Kumbhabhishekam*. During this period, the divine presence of the main deity in the temple is transferred from the idol that is worshipped to a pot, which is placed atop the *Balalayam*, and the original shrine regains its vitality only after the *Kumbhabhishekam* and when the main deity is brought back to the idol in the shrine.

Hence, the focus is on what the building holds, or stands for, in other words the spirit of the place, and not so much on what physically constitutes the building. This is fully consistent with the philosophy expounded of non-permanence of the physical matter, the transitory nature of the shell of every life-form, including buildings. Such a consideration raises fundamental questions on the approach to conservation of heritage in India, and possibly holds directions for the world at large. What is to be conserved? Is the extreme significance attached to the shell, in terms of the materials used and particularly their authenticity, in the context of conservation of heritage misplaced? Is it acceptable to sacrifice authenticity at the altar of the need for renewal or "rebirth" of the shell to sustain the spirit? Is it possible to sustain the spirit of the place or revive it in every instance?

5.3 Conflicting approaches to conservation

Consider some of the articles listed below from the guiding documents of protection of cultural heritage, namely the Venice Charter (1964) and the ICOMOS Charter (2003), particularly with reference to authenticity of material, minimal intervention, reversibility of intervention and reconstruction. These are the products of important deliberations among the numerous stakeholders of heritage in the last two to three centuries on different schools of thought in Europe: one represented by Viollet-le-Duc's "stylistic restoration" and the other on "conservation" by John Ruskin (in Seven Lamps of Architecture in 1849).

(1) The intention in conserving and restoring monuments is to safeguard them no less as works of art than as historical evidence [Article 3, ICOMOS, 1964].

(2) The aim of restoration is to preserve and reveal the aesthetic and historical value of the monument, based on respect for original material and authentic documents, and must stop at the point where conjecture begins. Any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp [Excerpt from Article 9, ICOMOS, 1964].

(3) Where possible, any intervention measures adopted should be reversible so that they can be removed and replaced with more suitable measures when new knowledge is acquired, and where not completely reversible, interventions should not limit further interventions [§3.9, ICOMOS, 2003].
(4) An incremental approach has to be followed, starting from a minimum level of intervention, with the possible subsequent adoption of a series of supplementary or corrective measures [§3.8, ICOMOS, 2003].
(5) The choice between "traditional" and "innovative" techniques should be weighed upon a case-by-case basis, and preference given to those that are least invasive and most compatible with heritage values [§3.7, ICOMOS, 2003].

Among the eight accepted approaches in conservation ordered in increasing degree of intervention, namely, prevention of deterioration, preservation of existing state, consolidation of fabric, restoration, rehabilitation, reproduction, reconstruction and translocation, it is evident that the primacy is of the material and the historical evidence that is encoded in them. In fact, restoration is considered rather invasive, and reconstruction is the penultimate option. In living monuments, and indeed India is filled with these, or where revival of activities, either similar or transformed (e.g. adaptive reuse) are intended, how applicable are these guiding principles? Should conservation efforts be directed towards preservation of the original, authentic skin, which will anyhow perish with the onslaught of time, a higher natural law? This may prove only to be an exciting engineering challenge.

The conservation strategy adopted by the Archaeological Survey of India in the Ta Prohm temple complex near Siem Reap, Cambodia is a case in point (see Fig. 7). Faced with the twin challenge of protection of both architectural and natural (vegetation) heritage, and several instances of complete collapse due to vegetation or other forces, the ASI has resorted to reconstruction in several locations, which sparked a serious debate with the International Coordination Committee (ICC), a UNESCO body set up to monitor the conservation of Angkor Park monuments. The approach adopted by ASI was only the natural course of action, given the philosophical understanding of *jeernodharana*. In fact, a reading of ASI's conservation manual penned by John Marshall in 1923 brings to light the conflicting approach to conservation of heritage, especially in the latter part of his statement: "When repairs are carried out, no effort should be spared to save as many parts of the original as possible, since it is to the authenticity of the old parts that practically all the interest attaching to the new will owe itself. Broken or half decayed original work is of infinitely more value than the smartest and the most perfect new work" [Marshall, 1923].

Figure 7: (a) Partially collapsed portions of the Ta Prohm temple complex in Cambodia; (b) Same portion after reconstruction (Courtesy: Archaeological Survey of India)

How does one then interpret the approach to conservation in cases such as the Veetrindaperumal temple at Veppattur near Kumbakonam in South India, an unprotected monument of staggering history? The structure that is currently seen was constructed on a plinth and walls composed of clay bricks with astonishingly thin mortar joints, whose constituents are unknown, and with the bricks probably dating back to the *Sangam* period (3rd c. BC to 4th c. AD) as deduced from their dimensions. This structure is being reconstructed with the aim of reviving the activity of worship in the precinct. What is the value one should attach to the historical evidence hidden in the first historical layer? Should the ruin be preserved?

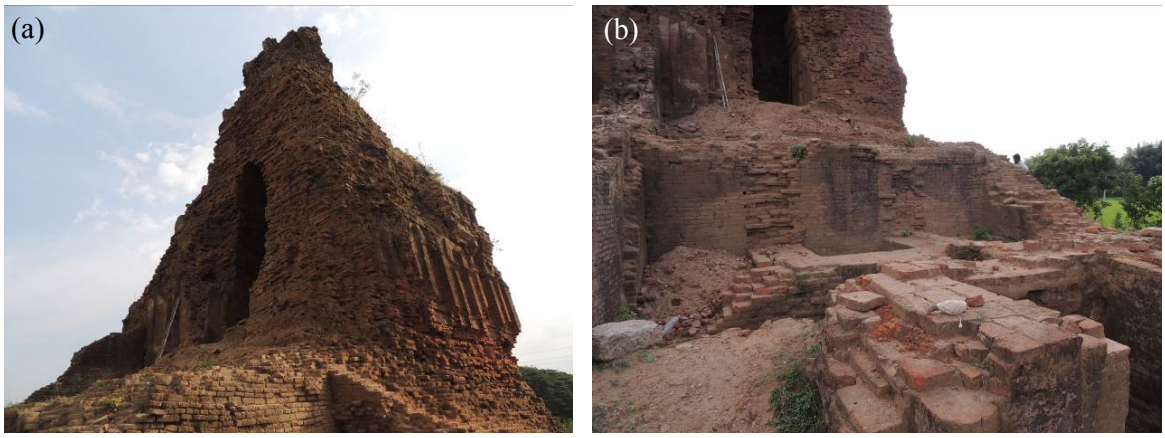

Figure 8: (a) Dilapidated structure of Veetrindaperumal temple at Veppattur (near Kumbakonam), South India; (b) Structure shows the evidence of clay bricks from the Sangam era (circa 3rd c. BC – 4th AD)

How does one interpret the approach to conservation at the archaeological site of Ashapuri near Bhopal, containing ruins of 26 temples from the 11th c. AD, protected by the State Archaeology of Madhya Pradesh, within a World Monuments Fund, New York and Government of Madhya Pradesh funded project. The cause for collapse of these structures remains unravelled; hence the site contains evidence that is not yet interpreted. In the current effort, one of these temples is being reconstructed based on conjecture (see Fig. 9). What is the value one should attach to the historical evidence hidden in the ruin? The reconstruction effort can be construed as the correct philosophical approach in the Indian context, where the focus is not so much on the material, but the spirit of the place and what the structure stands for.

Figure 9: (a) Ruins of Temple 5 at the Ashapuri archaeological site near Bhopal, India; (b) Deduced elevation details of Temple 5 (courtesy: SPA Bhopal, Cardiff University, WMF)

What was the rationale behind filling up of the Jagamohan of the Sun Temple at Konark in Orissa in 1903 (see Fig. 10a)? If this drastic measure was to prevent deterioration, was the focus primarily not on the "shell"? How do we address the conservation of the last of the Shore Temples at Mahabalipuram in South India (see Fig. 10b)? Inundation and erosion by sea water, and salt-spray action have taken their toll on these structures, and the extent of damage to the stone masonry is evident in the photograph. Can action of time (*Kālam*) be stopped in these structures, where the preponderance is of material?

Figure 10: (a) Record of the sand filling inside Jagamohan of the Konark Sun temple, Orissa in 1903 at the instruction of the then Lt. Governor Sir John Woodburn; (b) Shore temple at Mahabalipuram, South India (Source of images: Wikipedia)

6 CHALLENGES AND THE NEED FOR NEW PARADIGMS

A number of pertinent issues have been raised in sections 2 to 5 in an effort to find the right direction to cultural heritage conservation in India. They are interconnected and possibly the answer lies in finding an integrated solution to the national grand challenge of preserving the country's heritage for the world. Can the western approach to heritage conservation be applied to the Indian context without due consideration of the fundamental question of what needs to be conserved in the first place? The recent National Conservation Policy (ASI, 2014) strikingly resembles the international charters. The original authors of the international charters have been judicious is drafting overarching principles, that are tolerant and open to interpretation, and this has to be acknowledged. Their applicability to certain contexts can be problematic, particularly in the case of living heritage or monuments. Pragmatically speaking, it is possibly time to frame specific guidelines for conservation of living monuments or those that are intended for revival. These need not be region-specific implying differences in western and eastern approaches to conservation.

Such an approach to conservation is sustainable only if there is a broad relook at the current state of education, practice and market economy. As mentioned earlier, present day civil engineering and architecture curriculum lays almost no emphasis on traditional materials and practices of construction. The emphasis on ancient Indian wisdom is minimal in school education, primarily because there is hardly any mainstream research on these subjects. Traditional construction practices are not taught formally through programmes of education similar to the modern day structure, but knowledge is passed on from one generation to the next. If there are such schools, they are far too few in between. And these disciplines lack the exposure to modern day engineering approaches. While one of the biggest and possibly the most critical of the challenges is the shortage of expertise in the area of preservation of heritage,

cross-linkages between modern school and higher education and traditional Indian schools is crucial. The challenge also lies in identifying the diffused existing expertise in relevant sub-areas within conservation in India, networking, and scaling-up of efforts. One of the serious hindrances would be the diffused lack of knowledge of the ancient language of Sanskrit. For example, most of the ancient treatises on various arts and sciences were in Sanskrit (or other ancient languages such as Sangam Tamil), but modern-day engineers and architects rely on English translations to interpret them. It is very unlikely that these translations have been carried out by engineers or architects, and hence we are relying on second-hand interpretations. A first-hand interpretation could possibly help us stumble upon newer findings, but for which, a working knowledge of the ancient language is crucial.

There is essentially a need to effect pedagogical changes to the current mainstream education to bring in a rediscovery of the ancient wisdom of the country, but obviously not from a nationalistic sense. And for the content to effect pedagogical changes, years of fundamental research in traditional arts and sciences is the key. Interdisciplinary scientific research of Indian heritage is vital in achieving social relevance of heritage protection, which in turn will spawn new R&D and business opportunities in technological frontiers, such as material science, diagnosis and structural rehabilitation in India. Education and economy will play a crucial role is sustaining the efforts in heritage preservation. A national workshop conducted by the Ministry of Human Resource Development, Government of India (GoI) on Interdisciplinary Initiatives: Technology and Culture Interface at New Delhi in January 2013 was a step in this direction. The workshop was the genesis of the National Centre for Safety of Heritage Structures (NCSHS) at IIT Madras, established in July 2013, one such effort focussing on structural aspects of heritage.

7 THE ROLE OF NCSHS

7.1 Profile of NCSHS

Over the last two decades IIT Madras has been co-opted by national and state agencies (such as ASI; National Culture Fund, GoI, National Disaster Management Authority, GoI, Endowments Departments) to address challenges of structural safety of a limited number of distressed monuments and to prepare the national guidelines for safety of cultural heritage. In these experiences, the extreme neglect and lack of formalism in addressing safety of heritage structures was evident. As a step to address the national need, IIT Madras proposed to lead a national effort to begin a formal approach to address safety of heritage structures. NCSHS is envisioned as a long-term programme towards addressing the national grand challenge of ensuring structural safety of monuments and heritage structures in India.

7.2 Vision of NCSHS

NCSHS will:

(1) Act as a change agent in the heritage conservation scene in India, burgeoning a safety-centric interdisciplinary engineering approach to heritage conservation;
(2) Focus on long-term capacity building in the area of structural safety of heritage;
(3) Collaborate with implementing national and state agencies;
(4) Be a technical confluence of MHRD, other national ministries concerned with heritage structures, national and state agencies, to create the platform necessary for sustainable collaboration between stakeholders of structural safety of heritage structures;
(5) Work towards creating education and research opportunities in structural safety of heritage structures in many engineering and architecture institutes in India, and;

(6) Build much needed industry participants with background in structural safety of heritage structures, thereby creating new opportunities for industry.

7.3 Mission of NCSHS

As its mission, NCSHS will partner over the next 2-3 decades with implementing national and state agencies, autonomous bodies, private sector and engineering and architectural institutes of the country, to achieve the following objectives:

(1) Building reasonable quality and quantity of engineering manpower with background in structural safety of heritage structures, through formal education and training, and curriculum development;
(2) Initiating robust fundamental research on safety of heritage structures;
(3) Enhancing collaborative R&D between academia and implementing agencies;
(4) Providing technical solutions to conservation of prioritised heritage structures; and
(5) Documenting and disseminating state-of-the-art knowledge.

7.4 Strategy and Deliverables

Five sectors of R&D have been identified, namely: (1) Conservation Approach with focus on comprehension of traditional knowledge and Spirit in form, (2) Technology in Conservation, (3) Structural Analysis, (4) Hazard, Geophysics and Geotechnical Engineering, and (5) Education, Outreach, Policy and Coordination.

NCSHS is working towards providing the following tangible deliverables:

(1) Establishment of state-of-the-art facilities for experimental and analytical investigations on different facets of structural safety of heritage structures;
(2) Creation of the knowledge pool required to develop technical solutions for structural problems faced by heritage buildings, in implementing agencies, academic universities and professionals;
(3) Technical solutions for structural problems identified in consultation with stakeholders;
(4) Development of technical manuals and guidelines for safety assessment and retrofit;
(5) Long-term academic and technical cooperation between academia and implementing agencies, especially through joint research supervision by scientific personnel of implementing agencies and faculty members of academia; and
(6) Intellectual inputs to national and state governments on technical issues and technical policy development in conservation of heritage structures.

The secondary derivatives of the efforts of NCSHS will be:

(1) Initiation of a culture of research-based interdisciplinary approach to understanding structural behaviour of major monuments in India, thereby addressing structural safety;
(2) Creation of an enormous learning opportunity from the vast Indian architectural heritage for different knowledge forums, a key to safeguard, conserve and interpret rich Indian heritage;
(3) Concerted long-term research and pedagogical efforts, which translate into proliferation of new opportunities of learning and trade in civil engineering, structural engineering, architecture, material science and other allied fields of engineering, technology and commerce;
(4) Internalisation in curricula by a larger group of educational universities/institutes;
(5) Acknowledgement of value of heritage structures by the people of India; and
(6) National social relevance by offering holistic conservation strategy towards ensuring sustainable national heritage, a much needed national cause.

8 CONCLUDING REMARKS

- The challenge of conservation of cultural heritage in India is besieged by several practical aspects such as the profusion of built heritage in the country, but resource and skill-deficit in the formal approach to their conservation. This is due primarily to the lack of critical mass working in the area of heritage preservation, and the lack of focus of mainstream education, fundamental and applied research on this subject.
- On the other hand, the approach to conservation in India needs to be interpreted in light of the traditional focus on the spirit of the built form and non-permanence of material, which would be in strong contrast to established western principles of conservation that focus on the built form, interpreted as the receptacle of historical memory. Possibly, a fresh set of conservation guidelines for living monuments is called for.
- Holistic preservation of Indian heritage would require recourse to pedagogical changes in school and higher education intended to rediscover the ancient Indian wisdom in arts, sciences and philosophies, which hinges on mainstream fundamental research and R&D in the area. Economic viability of heritage will be a by-product of the process due to a revival of traditional arts and crafts, known popularly as intangible heritage, and initiation of new disciplines.

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