

A New Approach to Sustainability of Built Heritage

World Heritage Sites, especially monuments that are listed under United Nations Educational, Scientific and Cultural Organization (UNESCO) as being of special cultural or physical significance have always fascinated me. The heritage structures with immense historical, outstanding architectural and of considerable importance to culture and humanity is under threat to meet the demand of changed scenario of global economy, extreme environment and natural consequences. India is a country where one can find innumerable built assets of outstanding universal value originated from diverse tradition at different historic era. A cause of concern here is the engineering maintenance and preservation job commensurate with the existing historic structure for its safeguarding against the growing threat is still not properly emphasised. Particularly, in India preservation of heritage structure sometimes merely lead to just a civil patch work or repairing job which finally weakens the structural system of built heritage assets. Till now very limited work has been done in our country towards structural and material engineering approach in preservation of heritage monuments.

Sustainability of heritage structures as a live experimental engineering model other than social, aesthetic or historical model for future generation is yet to be explored in India. Take recent examples, the Dharahara Tower (Bhimfen Sthamva) in Nepal collapsed post the massive April 25, 2015 earthquake or fungal growth on Sanchi Stupa and many other heritage structures in India or deformation from the original alignment of structures strongly indicates that preservation of historic structures requires more explicit engineering efforts both for structural system and materials used. Focussed and precise efforts are of prime importance so that the historic structures can respond / withstand present environmental degenerating conditions, earthquakes and other natural disaster threats.

Taking into consideration all these extraneous factors we at ADO have developed specially designed support materials for engineering preservation. These special support materials will actually help in many cases to increase durability of the structures, better the performance of the structures, strength enhancement of the structures against extreme conditions and

finally to protect structures against environmental extremities. Repair technology is mainly concrete (as structural material) focussed and thus we are primarily having high grade concrete, durable concrete, etc. Till date limited progress has been made in the field of historic structural materials. We at ADO have initiated this special project towards durable and sustainable restoration and protection of heritage structures through some innovative approach by developing new construction materials compatible with old traditional materials like brick masonry and low strength lime mortar, etc.



As on July 2015, 1031 heritage sites are listed by UNESCO; of which 802 cultural, 197 natural and 32 mixed properties, in 163 countries. According to the sites ranked by country, India has 32 world heritage sites. UNESCO considers it in the interest of the international community to preserve the heritage sites. This provoked me to work out a judicious mix of technology and skill so that the quality and durability of heritage structures can be scientifically preserved.

India has 32 World Heritage Sites of which 25 are Cultural and 7 are Natural. The big question is how the heritage structures are being restored and maintained. Let's take an example – Sanchi Stupa the famous Buddhist *vihara* commissioned by emperor Ashoka in 3rd Century BC. Its nucleus is a simple hemispherical brick structure built over the relics of Lord Buddha. It was crowned by a *chatra like* structure, a parasol-like structure symbolises high rank, which was intended to honour and shelter

the relics. Sanchi is famous in the world for stupas, monolithic Asokan pillar, temples, monasteries and sculptural wealth.

The pertinent concern here is how the structural preservation and restoration job is being carried out in the real application stage. Obviously the need arises from practice, from the immediate requirements to solve problems encountered in structural restoration of built heritage. Perhaps architects, landscape architects, conservators, archaeologists and the entire body of heritage conservation professionals have limited expertise to solve the structural problems like risk of collapse of

many traditional historic structures to withstand the extreme load consequence like earthquake and severe environmental conditions. Modern techniques and materials are admissible in these cases but its durability and compatibility with the original material should be adequately proven.

Techniques of restoration is another important criteria in engineering restoration work. In brief, heritage restoration technique and application of material can be classified into two categories:

1. Reversible
2. Irreversible

Reversible preservation techniques and materials are those which can easily be replaced with better option and technique in later stage as a temporary strengthening technique.

Irreversible technique is rigid and permanent in nature, removal of which can injure the originality of the historic value of the structure.

Our initiative is focussed in these particular areas of preservation engineering by effective interface of advanced knowledge, materials and techniques for restoration of heritage structure.

This is quite an innovative initiative in Indian context. All concerned associated in the initial and formative stage of the project is very excited about it. These great heritage monuments are an epitome of engineering science as well as of enormous cultural and historical importance. Scientific and engineered approach towards restoration and retrofitting of these heritage structures are of prime importance. We need to understand and appreciate the fact that the construction materials with which these historical structures were built are not our modern day regular construction materials that are readily available in the market. We at ADO are relentlessly working on the development of some kind of specialised construction materials for these types of restoration jobs. Such type of specialised construction materials and techniques are so developed that it could easily become an integral and irreversible but compatible part of the existing material and structural system. Restoration job of any historical site is possible with specialised similar-type construction materials. It's time for us to understand that we have the responsibility to scientifically preserve these heritage sites for generations



the system, accelerated degeneration of structural materials and so on. It has been observed in many cases that it is just an ordinary repair job without taking into account the root cause of structural degradation of the historic asset. This challenged us to come up with this unique project on engineering preservation of heritage sites for the first time in India.

Ado Additives Mfg Pvt. Ltd. recently approached Construction Engineering Department of Jadavpur University, Kolkata to form a special knowledge centre for working towards engineering preservation of historical monuments. The objective of this technical unit is to take up ground level research on traditional historic materials and through direct knowledge sharing with academia (Department of Construction Engineering, Jadavpur University, Kolkata). The use of traditional materials is always preferable for structural restoration work. In practice it is found, adequate strength / capacity cannot be ensured in case of

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to come. The historical and cultural legacy of India should be preserved and passed on.

This specialised engineering preservation centre will operate both as an academic excellence centre and a special technical service business unit through development of new materials, techniques and through specialised skill development program. A technical training academy under the guidance and supervision of eminent scholars will be set up with an objective of creating trained professionals. Development of Preservation Engineering as a specialised trade and academic field is yet to develop in India. This innovative initiative has the potential of creating trained professionals across the country; these trained professionals can then provide the right technical services for engineered preservation of historical sites. Thus not only there will be a fleet of trained professionals, it will open a new avenue of employment and career scope. India is a labour abundant country and unskilled labourers migrate to the cities for employment opportunities. If these unskilled labourers can be trained properly then they can be turned into demographic advantage for the execution of engineered preservation of historical sites. Moreover, India has huge resources of community based traditional skill, which is currently on a diminishing stage, shall also be developed through this unique initiative. Thus there will be easy supply of specialised skilled manpower for the project. Also special local self-help group can be created among the community where the origin of traditional skill stock can be found, for long term daily maintenance of scientifically restored historical structures.

Immense technical progress has been made in the sector of construction chemicals, but its application has remained faulty in most cases as is evident by observing various heritage structures. Due importance in preserving heritage monuments has never been felt. Also no proper technology (engineered knowledge based) has evolved over the years, which is a constraining factor. There are certain Government agencies that are primarily being responsible for maintenance and restoration of heritage structures in India. It has been widely noticed that proper application of technical knowledge coupled with ground level skills for execution of this type of specialised restoration work is completely lacking, which reflects the lack of proper appreciation for this type of knowledge and skill specially required for preservation of heritage structures. As a result, concerned authorities have no other option but to go for the so called readily

available trade based knowledge and common trade practices, which are ultimately turning out detrimental for preservation of heritage monuments. It is high time that we should think long term and choose the right technical solution.

It is to be noted that monuments and historic assets are threatened by global warming, extreme natural consequences with aleatory variability and epistemic uncertainty, pollution, etc. It is very disheartening to note that some of our fellow countrymen's irresponsible behaviour is doing an irreparable damage to these invaluable archaeological and architectural masterpieces by inscribing their initials, names, places, addresses or messages on these national treasures. Structural restoration and protection of these monuments cannot be neglected any further and it's time for us to act.

India has a rich heritage, which includes a repository of historic architectural structures and incredible monuments. This cultural history epitomised in heritage monuments stems from our historic past of ancient civilisation. The Taj Mahal, Agra Fort and Fatehpur Sikri in Agra, the Konark Sun Temple, Khajuraho Temples, Mahabalipuram Monuments, Thanjavur, Hampi Monuments as well as the Ajanta, Ellora and Elephanta Caves are some of the monuments that we are proud of. Every country and society has a precious heritage, which has to be and can be transferred to the next generation and it is the responsibility of the civil society to transfer that heritage to the next generation for them to feel and learn. I am confident that this special joint initiative of preservation engineering of historical monuments by Ado Additives Mfg Pvt. Ltd., Kolkata with support of Jadavpur University, Kolkata will open new opportunities, contribute to the local well being and above all transfer the rich heritage across generations. As we close the year and usher in a new beginning, let us start contributing in a small but significant way towards preservation of our national heritage structures. I am sure that preservation engineering of heritage monuments project will provide direction to the future of the industry also.



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