

# **An Exploratory Study of the Applicability of Various Systems of Ancient Architecture to Modern Sustainable Construction**

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## **1. Introduction**

It is no secret that Sri Lanka has achieved an architectural wonder since the eras of ancient civilizations such as Anuradhapura and Polonnaruwa. Looking at the ancient city plans of the time, from hydraulic systems to natural materials, reveals many valuable lessons for modern sustainable construction design. Ancient architectural wisdom has shown solutions such as energy efficiency, environmentally friendly durable building construction techniques to successfully face the challenges of climate change, depletion of resource reserves and rapid urbanization, which are faced globally day by day. The purpose of this research is to examine modern sustainable construction by proposing a methodology for adapting past architectural techniques to the current construction industry.

Much research has been done on the excellence of ancient architecture and on modern architectural design, but very little has been done experimentally comparing ancient architectural techniques with modern architecture. This research is done impartially to fill that gap. This research is limited to whether the ancient architectural knowledge of Anuradhapura and Polonnaruwa.

## **2. Materials and Methods**

This study is concerned with providing a comparative analysis of ancient and modern architectural techniques. This research has been done by taking the field observations are Anuradhapura as basic data. Also, historical architectural records, raw materials (brick, stone, wood) are examined and compared and contemporary architectural knowledge on sustainable building construction practices is reviewed. Ancient and modern architectural techniques were analyzed by field observations, analysis of historical documents, and studies undertaken for comparisons. In Anuradhapura and Polonnaruwa, the field observation allowed first-hand information to be gathered regarding the features and techniques used in ancient constructions. In addition, analysis was carried out on historical architectural records to understand how methodologies and materials were used. This was accompanied by the review of current sustainable building practice to identify parallels and potential applications of ancient techniques in modern contexts. Qualitative comparative analysis was the primary method utilized in this research. This involved it systematically compared ancient architectural techniques with modern sustainable construction practices. The research also included a literature review of the existing studies available on ancient Sri Lankan architecture and modern sustainable design principles.. The multifaceted approach enabled a comprehensive understanding of the applicability of ancient techniques to modern construction. Materials for this research were gathered from various locations and resources.. Field observations were conducted at Anuradhapura, where these historical architectural sites can be found. The historical architectural records were obtained from libraries, archives, and academic institutions dealing in history and architecture, especially as it relates to Sri Lanka. Further, the knowledge of modern architecture has been obtained from very recent publications, research papers, and case studies related to sustainable building. This thus provided a firm basis for

comparative analysis. A comprehensive review of existing research on ancient Sri Lankan architectural background and modern sustainable design principles has been undertaken.

Documentary information on architectural techniques, materials and environmental adaptations of historical cities such as Anuradhapura, has been investigated. It also emphasizes the extent to which methods such as water management and construction using local materials have influenced contemporary construction. Primary sources for this research include on-site observation and analysis of ancient constructions and materials in Anuradhapura. Field studies provided direct knowledge of the architecture pertaining to materials such as bricks, stone, and wood. In addition, historical records in the form of inscriptions and ancient texts present in archives were researched in order to gain an understanding of traditional methods of construction. Secondary sources utilized in this paper thus include current scholarly works, articles, and books pertaining to sustainable architecture. These secondary materials interpreted the ancient techniques in light of modern sustainable practice, thus providing a comparative basis for the research. Collectively, these sources will enable a comprehensive analysis of how ancient architectural wisdom can inform current sustainable construction methods.

### **3. Results and Discussion**

The study revealed several strategies that can be used in modern constructions of ancient Sri Lankan architectural knowledge. Ancient Sri Lanka's hydraulic systems, particularly in the cities of Anuradhapura, exhibit advanced water management techniques. The intricate networks of reservoirs, canals, and retention ponds not only provided essential water for agriculture and daily use but also demonstrated early examples of integrated urban planning with sustainability in mind. For example, tanks and reservoirs in Polonnaruwa like the Parakrama Samudraya reflect a profound understanding of water storage and management, ensuring the community's resilience during dry periods. These systems can be adapted in modern urban environments to address contemporary challenges, such as water scarcity, rainwater harvesting, and stormwater management. By integrating natural reservoirs or retention systems within cities, urban planners can reduce the demand on municipal water supplies and enhance resilience to climate variability. The subject matter is highly relevant and notably contributes to your research objectives. It provides a complete example of how the ancient water management techniques, such as those in Anuradhapura and Polonnaruwa, are highly sophisticated in terms of their sustainable practices. By placing focus on these historical systems, such as Parakrama Samudraya, the emphasis is squarely on how adaptable it is to modern challenges, which is precisely your objective: to explore ancient Sri Lankan architecture in regard to applicability to modern sustainable construction. It would also provide a perfect opportunity for the foresight into the role traditional knowledge could play in resolving some of the environmental problems being faced today, such as demonstrations of rainwater harvesting, techniques for overcoming water shortage, and stormwater management.

Ancient Sri Lankan structures, particularly monastic complexes and royal palaces, utilized the thermal massing properties of large stone blocks and thick brick walls to naturally regulate temperature. This passive cooling mechanism reduced the internal temperature of buildings during hot days and retained warmth during cooler nights. The Sigiriya Rock Fortress is a prominent example where the strategic use of natural materials enabled temperature control without relying on external energy sources. Modern architecture can benefit from these principles by incorporating local, thermally efficient materials such as stone and compressed

earth blocks to reduce reliance on mechanical cooling and heating systems, particularly in tropical climates. This can significantly lower the energy consumption of buildings, contributing to reduced greenhouse gas emissions and promoting long-term energy efficiency.

Ancient buildings in Sri Lanka were designed to maximize natural ventilation and lighting through the strategic placement of open courtyards, windows, and verandas. Monastic structures like the Jetavanaramaya Monastery and Abhayagiri Monastery in Anuradhapura incorporated courtyards and open spaces that allowed air to flow freely, creating a naturally ventilated environment. Jetavanaramaya and Abhayagiri Monasteries in Anuradhapura are the major ancient monastic complexes in Sri Lanka. The two great monastic cities were designed outstandingly and are known for their architectural properties. To be stated precisely, in the case of the Jetavanaramaya Monastery, with the presence of this tall stupa known as the Jetavanaramaya Stupa, the monastic complex comprised living rooms, meditation halls, and open courtyards that allowed natural ventilation so that comfort could be given during the tropical climate. Similarly, the Abhayagiri Monastery, identified as one of the most famous monastic and cultural centers, was also designed to house residential places, assembly halls, and courts, which were planned in such a way that proper flow of air could be obtained. Both monasteries represent an adaptation to the climate of the early Sri Lankan architecture and include methods in passive cooling and natural ventilation that are in line with modern sustainable practices. These designs not only provided thermal comfort but also reduced the need for artificial lighting and air conditioning. Modern architecture can integrate these principles by using open floor plans, ventilation corridors, and strategic window placement to enhance natural airflow and lighting in buildings, further reducing energy consumption.

The ancient builders of Sri Lanka relied on locally available materials like laterite stone, clay bricks, and timber. These materials were not only abundant but also environmentally friendly due to their low carbon footprint and minimal transportation requirements. Furthermore, these materials aged well and were naturally integrated into the surrounding landscape, promoting environmental harmony. The use of natural lime mortar instead of modern cement also allowed structures to "breathe," contributing to indoor air quality. Modern architecture can adopt similar practices by focusing on locally sourced materials and sustainable construction practices. This will reduce the environmental impact of building materials and promote the longevity and sustainability of modern structures.

#### **4. Conclusion**

It can be concluded that ancient Sri Lankan architectural techniques provide valuable insights into resource efficiency, environmental harmony and energy conservation for sustainable design. If these methods are adopted, the planners can carry out constructions in accordance with the environmental requirements in accordance with the Sri Lankan climate. This study proposes the integration of archaeological knowledge into modern construction by adapting these techniques to modern goals and reusing lost techniques.

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## **6. Key words**

Archaeology, Architecture, Construction, Sustainable development.

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