Adaptive Reuse of Heritage Buildings for Sustainable Urban Regeneration: Two Case Studies from India.

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Abstract

In the era of globalization, developing existing cities into smart cities while providing a higher quality of life to the citizens is one of the strategies in many countries. In the process, many traditional settlements and cultural heritage are being demolished without respecting their values. In fact, these heritage buildings could be easily re-used. However, a proper approach is essential in ensuring their relevance in urban regeneration projects. Undeniably, cultural heritage should be preserved with their values.

One of the ways to do so is through adaptive re-use, i.e., reusing the existing building for contemporary use, making it a part of sustainable architecture. Appropriately, the reuse of heritage buildings or materials therein saves much of the embodied energy. This will help improve access to clean energy and encourage adoption of low-carbon energy assets. The concept of adaptive reuse of different buildings has been successfully implemented in many countries.

This paper examines the issue of multifaceted challenges in adaptive reuse, emphasizing the need for informed decisions based on in-depth assessments. The paper seeks to understand the compatibility of new functions with the physical and historical integrity of heritage structures, the conservation of embodied energy inherent in these buildings, and the pivotal role of stakeholders in driving successful adaptive reuse projects.

It employs a mixed-method approach using case studies, stakeholder surveys, and heritage building analyses to determine best reuse solutions. The study shows how adapting old buildings saves energy and the environment by comparing them to new buildings.

It concludes revealing the current efforts to provide ways of such reuse of heritage buildings based on several sustainable benchmarks and valuable considerations.

Keywords: Adaptive Reuse, Climate Change, Heritage Preservation, Sustainable Architecture, Smart City Approach.

Introduction

Climate change mitigation is a national emergency in any country in the current global environment, according to the United Nations. The United Nations General Assembly adopted "The Paris Agreement" on November 4, 2016, as an international convention to decrease greenhouse gas emissions that have a climate impact in order to keep global warming below 2 degrees Celsius (Anonymous, 2021). In order to reach energy-efficiency objectives, a total of 101 nationally determined contributions (NDCs) have been supported by various countries, with the construction sector receiving particular attention. Among them have been 49 nations that had pledged to use renewable energy sources in buildings in order to promote clean energy and foster the development of low-carbon assets. The Agreement's implementation is also critical to the fulfilment of the Sustainable Development Goals (Australian Government, Department of Environment and Heritage, 2004).

During the late 20th century, diminishing of fossil fuels, increase in energy prices, and the erection of most resource-consuming structures took place. This has led to growing uncertainty about the future quality of life for the public. It has resulted in a good awareness of the relationship between buildings and the environment. Many architects have expressed their interest in planning for sustainable architecture as an attempt to minimize the negative environmental impacts of buildings. This has led to the efficient use of energy, renewable materials and the minimization of greenhouse emissions. There was a strong emphasis on ecologically friendly design elements such as "low energy, green energy, recycling materials, and passive solar radiation," among other things. However, none of these initiatives have had much effect, either in terms of climate change or in terms of environmentally friendly design techniques (Al Dein, 2022).

When upstream power generation is included, global energy use and carbon dioxide (CO2) emissions from building and construction accounts for a total of 36% and 39%, respectively (UNEP, 2019). New constructions use 40% of the energy and raw materials use each year, 25% of the wood that is cut down. Moreover, they also use 16% of the fresh water sources, 44% of the trash, 45% of the carbon dioxide that is made, and up to 50% of the greenhouse gas emissions from all industrialized countries.

In this context, when new constructions are compared with adaptive reuse of buildings, embodied energy costs for the former will be far more than those for the latter. Recycling building materials results in a substantial reduction in greenhouse gas emissions, and thus the reuse of historic buildings makes good economic sense because they reduce carbon emissions. It turns out that adaptive reuse of historic structures is hard because the building values, physical qualities, and other potentials are complex and must be carefully looked at before any new functions can be found that make sense (Sizirici, 2021).

Adaptive reuse of heritage or extremely old buildings benefits the environment, landscape, identity, and amenity of the communities involved significantly (Singh, 2019). Moreover, reuse saves embodied energy and preserves historical buildings for contemporary use. Through social, environmental, and fiscal benefits, such a strategic approach reintegrates life into the historical context

Currently, "adaptive reuse projects" feature is based on random decisions rather than an in-depth investigation of heritage structures (Gunc, 2019). It is necessary to evaluate adaptable reuse of heritage buildings as part of a sustainable urban regeneration strategy and to promote the process planning of such adaptation into methodical urban planning.

This paper examines the issue of the complexities surrounding the process of adaptive reuse of heritage buildings, within the framework of sustainable development. In light of increasing apprehensions regarding climate change mitigation, the study highlights the capacity of repurposing heritage buildings to achieve a harmonious equilibrium between the preservation of the environment and the safeguarding of cultural property. It investigates the many obstacles associated with adaptive reuse, highlighting the importance of making well-informed decisions through thorough evaluations. It to examine the extent to which new uses may be integrated into heritage structures while preserving its physical and historical integrity. Additionally, it also intends to explore the conservation of embodied energy that is inherent in

these buildings, as well as the crucial role that stakeholders play in facilitating successful adaptive reuse initiatives.

Its aim is to investigate the potential of repurposing historic structures to balance environmental, cultural, and developmental needs, reducing carbon footprints and conserving the intrinsic value these structures hold for the community.

Its objectives are:

1. To define the concept of adaptive reuse within the framework of heritage conservation, and assess its impact on both the architecture and the surrounding spaces that contribute to sustainable development.
2. To identify the factors and decision-making processes involved in selecting heritage buildings for adaptive reuse, considering various socio-economic, environmental, and cultural perspectives.
3. To establish the sustainability goals associated with building reuse, such as eco-efficiency, energy conservation, and community value, and evaluate their implications in the broader context of urban development and climate change mitigation.

The study is presented in four parts. The first part provides the theoretical basis and deals with adaptive reuse in the original context of the heritage. The second part considers the factors involved in decision making. It then examines a case study of a retrofitted heritage building for proposed adaptive reuse. Finally, it offers a proposal for reuse with alternatives followed by planning, obsolescence status, analysis of the heritage based on sustainable design concepts, and evaluation of benefits and limitations.

Theoretical Framework

Adaptive Reuse of Heritage Buildings

The most significant challenge in adaptive reuse is the arbitrary decision to assign a new use to a heritage structure. Mısırlısoy and Gunce (2019) argue that every decision to expand the use of a substance should be firmly founded on in-depth analysis through scientific methodologies. In several parts of the world, heritage buildings are often renovated and repurposed. It is, however, difficult to make a "reuse selection" of such properties since there are many diverse perspectives among the specialists, administrators, and other stakeholders involved. However, an appropriate reuse selection evaluation technique can help in expediting the process of sustainable building conservation. Adaptive reuse, according to conventional definitions, is the act of repurposing an existing building for a different function than the one for which it was originally planned, or for a purpose other than the one for which it was originally intended. Even though this strategy can be used to change any type of built structure, it is most often used to change historic structures that are important to the history of a community (Gunc, 2019)

Ideally, adaptive reuse of a historic building should have a minimal impact on its heritage significance, including surrounding spaces that play a vital role in sustainable development (Singh, 2019). In fact, reuse is another form of preserving a heritage, acknowledging architectural values, its history, culture, environment, landscape, and identity belonging to the communities concerned, while honoring the craftsmanship and architecture of its predecessors as a virtue that a space holds for the future (Bullen, 2011).

Retention of the physical fabric of a historical area usually provides the basis for cultural tourism, accommodation and associated visitor services while creating opportunities for employment in the local communities (Kigadye, 2011). Furthermore, the act adds to the sustainability of urban regeneration initiatives, extends the building's life cycle, eliminates demolition waste, supports energy-efficient solutions, and delivers considerable socio-economic and environmental benefits (Kalaci, 2014). Thus, reuse of buildings consume fewer resources, results in an overall reduction of environmental impact and saves on the generation of new carbon footprints (UNCC, 2023).

As mentioned earlier, adaptive reuse involves converting a building for a change of use as required by the existing or new owners and may mostly require minor restoration work

where nothing changes except the building's functional use (Baker, 2021). The change of use may require refurbishment and/or complete renovation of the existing buildings or structures. In most Australian states, adaptive reuse invariably involves changing the function of a disused or ineffective building (Australian Government, Department of Environment and Heritage, 2004). Changes to buildings involve major internal space reorganization and service upgrades or replacement.

Adaptive Reuse and Sustainability

It is often argued that the goals of building reuse must promote eco-efficiency, economic viability, energy efficiency, extension of building life cycle, sense of place retention, visual amenity, and value to the local community. Energy consumption is minimized, renovation materials are used to their full potential, and destruction is avoided by repurposing rather than demolishing. Greenfield sites are also less likely to be needed (Al-Nuaimi, 2023).

Reuse of heritage buildings needs to consider a number of crucial factors along with the principles of architecture, culture, economics, environment and sociology. According to the Royal Australian Institute of Architects (2008), there should be minimal changes to the layout, context, and fabric of the building in order to assess and pick an optimal choice for new uses of heritage buildings.

In addition, historical, emotional, experience, visual, and any other possible use-values should be thoroughly examined (Sandbhor, 2013). The Architectural Institute of Japan has prepared a set of guidelines for evaluating historic buildings for preservation and reuse based on five factors (and basic elements): culture and artistry, environmental aesthetics, history, social context and norms, and technology (Kanematsu and Terayama, 2007)). Five more criteria have been added to them to obtain the maximum reuse value of the existing heritage buildings, viz., physical condition, location, maintenance, estimated profit margins, and servicing (Shehada, 2015).

Dabouh (2015) has chosen the aforementioned social, environmental, architectural, economic, and cultural values as criteria, dividing each into sub-criterion for ease of decision making of a heritage for reuse. The sub-criteria were: meeting the region's needs and enhancing the quality of life under social value; congruity with land uses; accessibility of the building by differently abled users, vehicles and pedestrians as environmental criteria, suitability of the new function with the building system and new space requirements; respect to the building's ancient architectural features and ornaments; building physical stability; respect to the region’s bye-laws and building codes as sub-criteria under architectural criterion; economic impact on the building and district, adaptation cost as an economic sub-criteria, and protection and enhancement of heritage significance as sub-criteria under cultural values (Shehada, 2015).

Traditional buildings and structures that have survived throughout history are informative indicators of the civil and cultural lives of the previous societies, which ensure social and cultural sustainability (Kagan, 2019). Adaptive reuse helps the present communities to maintain and restore the historical significance of a building and supports its survival rather than its gradual disappearance because of neglect. Those that have been reused or renovated continue to be used and appreciated (Singh, 2019).

Apserou (2014) suggests important factors for adaptive reuse as cultural significance, life cycle assessment duration, heritage significance, effectiveness in meeting sustainability benchmarks (economic feasibility, environmental sustainability, social viability), value to the local community, orientation of a building, influence on the local economy, technical fitness of the building, and stakeholder’s views/perspective (Apserou and Ourania, 2014). A successful adaptation respects the existing building and its historic context while adding only a contemporary layer that enhances its life cycle.

If adaptive reuse initiatives are to be financially successful, either their optimum usage or dual use is important. In the case of these projects, the criteria are measured project-wise as cost recovery, return on investment, multiplied tourists or visitors, enhanced work efficiency, etc. To achieve the desired economic goals, the available total spatial potential, including marginal spaces in the heritage building must be used for the new functionality (James, 2006).

Selection for inappropriate use of a heritage building can lead to loss of its value (Haroun, 2019).

According to Shehada (2015), the objective must be to develop an inclusive methodology based on various pertinent issues to arrive at an optimum adaptive reuse selection of a heritage building before making any decision on the intended activity of reuse. A theoretical framework has to be constructed to initiate the planning process. Hence, a study to understand site-level potential of a heritage structure must be developed.

Compatibility

As argued, it is necessary to conduct an in-depth analysis of the requirements and spatio-physical characteristics of a heritage building before making a determination regarding whether or not a new function will be compatible with the building (Claver, 2018). Gunce and Misirlisoy (2019) say that it is very important for adaptive reuse projects that involve continuity of function to be able to respond to user needs and make sure that those needs are met (Gunc, 2019)

Embodied energy

Conservation of the embodied energy of the building's original construction is one of the most important advantages associated with the adaptive reuse of historic buildings. If sites are reused, the energy they already have will be kept. As a result, the project will be better for the environment and last longer than the ones that involve building a new building from scratch. It will also leave less of a carbon footprint (Okba, 2013).

Stakeholders

Adaptive reuse usually happens when a building or its environment is found to have some potential, especially by stakeholders (Sandbhor, 2013) Further, the success of the project depends upon a number of factors spelled out by Apserou (2013) as mentioned previously, besides its influence on the local economy and adaptability of the building. In some surveys by Bullen and Love (2011), respondents have given higher weightage (83%) to heritage significance than for cultural significance (68%). The proposed function of the building shall socially and economically benefit the community, safeguard stakeholders' interest in it, and establish the level of their intervention in the architectural and functional aspects.

Research Methodology

This research examines a case study in Visakhapatnam, India. Its intention is to comprehensively assess the importance of adapting heritage buildings for sustainable urban revitalization and cultural heritage preservation amidst globalization. It highlights the value of conserving cultural heritage and investigates adaptive reuse as a sustainable architectural solution. Notably, reusing heritage structures can conserve up to 95 percent of embodied energy, fostering clean energy accessibility and low-carbon assets. By analyzing global examples, it produces guidelines rooted in sustainable benchmarks, informing effective adaptive reuse practices for promoting both sustainable urban renewal and cultural heritage safeguarding.

It employs a case study and a survey as research methodologies. Visakhapatnam was chosen as the case study. The research delves deep into the social, environmental, and fiscal benefits of adaptive reuse, in this city aiming to reintegrate life into historical contexts. A questionnaire survey was conducted in Visakhapatnam, gauging public opinion, and identifying the best proposals for reuse. It ascertained the needs of the local population in terms of heritage preservation and sustainable urban regeneration. Data which estimated the environmental aspects and social viability were also collected.

Interviews were conducted with randomly chosen street dwellers, with whom adaptive reuse was discussed in terms of cost-effectiveness, availability of sympathetic materials, and the conservation benefits of retaining older buildings.

The Case Study Area: **Visakhapatnam**

Visakhapatnam is the largest metropolis in Andhra Pradesh and the seventh largest in India. It is one of the 100 fastest growing cities in the world. As per the 2011 census, its population is 1.728 million. It has been selected amongst the top 20 cities in India as part of the Smart City Mission under the Ministry of Urban Development (MoUD) of the Government of India in partnership with Bloomberg, USA for the Smart City Challenge program (Aecom, 2023). In order to promote Visakhapatnam as a smarter city, the government of Andhra Pradesh received financial aid from the US Trade and Development Agency (Diwadkar, 2023).

Sustainability of Local Heritage

Smart City approach

The planning and administrative wing of the local government has adapted the five-layer concept to foster Visakhapatnam as a smart city and has defined the city's attractions, viz., real estate development as the first layer, basic infrastructure as the second layer, smart infrastructure as the third layer; life services and lifestyles as the fourth layer; and culture and art as the fifth layer (Mohammed, 2022). Culture and art have taken center stage in the last two layers of this concept, which emphasize an excellent quality of life in a low-carbon society.

As a consequence, quality of life within the historic settlement areas needs to be improved a lot, but this action leaves a large footprint in the zone. The availability of open spaces to construct new buildings or infrastructure in the core area is meagre. Such demand, along with land scarcity, generally results in the demolition of existing buildings (De Silva, 2019) At this critical juncture, a feasible alternative is to replace highly dilapidated heritage buildings with new ones or convert partially dilapidated structures for adaptive reuse through appropriate technologies so that fresh carbon footprint creation is successfully reduced.

In line with the Nationally Determined Contributions (NDC) and Sustainable Development Goals of the Paris Agreement, local governments "reuse" existing historic buildings rather than creating as much new infrastructure as possible. When compared to new construction, this saves approximately 95% of grey energy while minimizing environmental impact. Greater Visakhapatnam Smart City Corporation (GVSCCL) successfully restored two partially abandoned heritage buildings and smart city missions, maintained their original structure, and implemented a concrete energy concept. Apart from this first attempt, the preservation of the monuments of the city of Visakhapatnam is quite impressive (Kumar, 2014).

City-based themes are very important in developing a theoretical framework for examining heritage adaptive reuse. This can be studied through a reconnaissance survey of the city, while planners must understand the heritage environment and the nature of the environment around it. The study of heritage environments involves heritage architecture, heritage style, history, cultural atmosphere, and culture as theoretical aspects within the framework. An analysis of the nature of the environment entails a leisure atmosphere, a natural landscape, and a safe environment for tourists and residents. Supportiveness of the overall regional environment and surrounding attractions should encourage local tourists, transportation accessibility, historical street character, and availability of activities like food and heritage walking, etc., that preserve positive emotions of the city and the hope of the locals for a good life (Pintossi, 2019).

The Study: Proposed Adaptive Reuse Buildings at Visakhapatnam City

Conservation of heritage buildings under smart city program

The Greater Visakhapatnam Municipal Corporation (the local government) retrofitted two British Colonial heritage buildings for conservation in 2017 and completed the work in July 2021. The total cost of retrofitting was ₹109.7million. The first is "Victoria Diamond Jubilee Town Hall", constructed in 1904 and spread over 670M2 (₹41.3million) and the other Municipal Office was constructed in 1930 over 1150 M2 of space (₹.68.4 million). Both are located on the same premises of about 2.4 ha. The former was used as the center of theatrical, cultural, and literary events till 1960 and later as the municipal administrative office. Of late, the planning authorities are contemplating putting them to adaptive reuse.

Case Study 1: Victoria Jubilee Town Hall (1904) Approx. 670 sq.mt.

Historical value

The Victoria Jubilee Town Hall building was constructed on the ground and first floors with a plinth area of 670 square meters by the Rajah of Bobbili between 1901 and 1904 in the Fort ward of the One Town and inaugurated in 1904. This building was commemorated for the Golden Jubilee celebrations of the British Queen Victoria with facilities to accommodate the Vizagapatam Club for British officers, royal and alight families on the ground floor and space for the Municipal Council to conduct their activities on the 1st floor of the building. The plans were prepared by the British Military Engineers in honor of the then Queen Victoria of England. The twin facility was inaugurated by R.H. Campbell, the then Collector and Agent of Vizagapatam, on behalf of His Excellency the Right Honorable Lord Ampthill, the then Governor of Madras, in 1904 (Kumar, 2013). The first floor was handed over to the Municipal Council for conducting meetings as well as other important events to benefit the public, and the ground floor to the Vizagapatam Club for recreation, leisure, sports and allied events for the benefit of the club members and their families. It is important for showcasing the special and rare features of the colonial style of architecture and, with amalgamation, local traditional residential architecture. This place has aesthetic value and is important due to its contribution to the development of the city's growth in history. This place has a unique connection with the local community for cultural and social reasons. Historic objects dating back to the 1910s from British times, such as the original billiards table with a cue and scoring board on the wall, are well preserved even to this date on the ground floor of the Vizagapatam Club (Kumar, 2013).

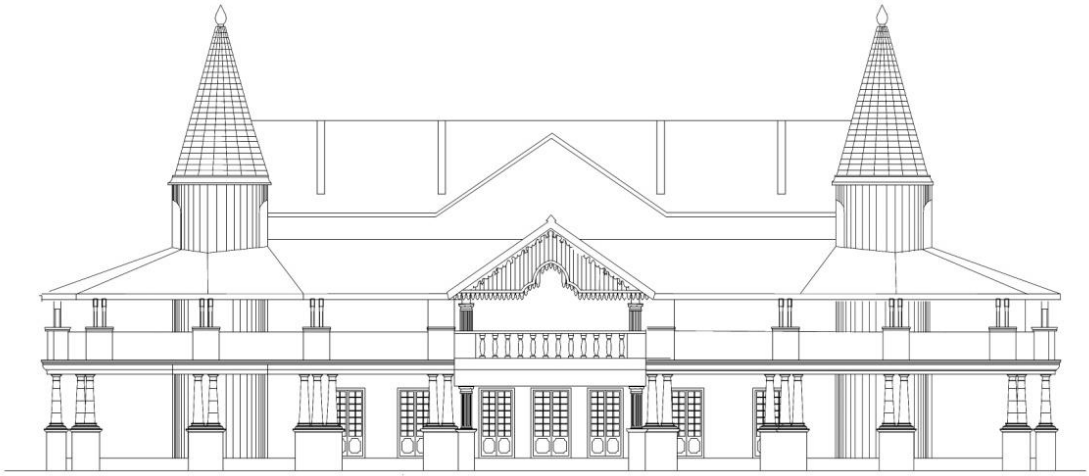

Fig. 1: Victoria Jubilee Town Hall Front elevation
Source: Author

Fig. 2: Victoria Jubilee Town Hall Rear elevation
Source: Author

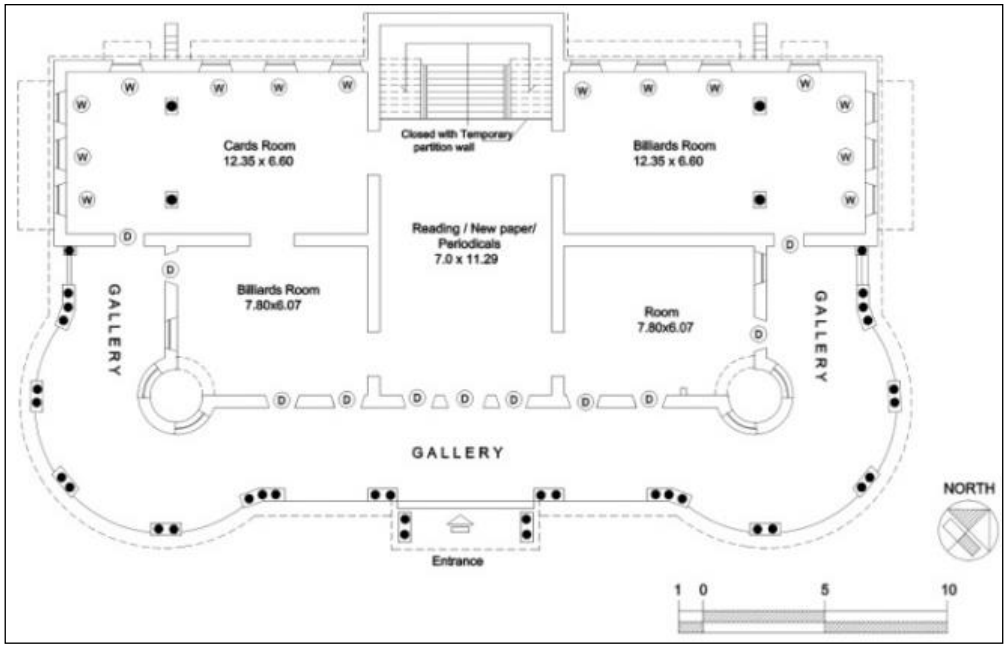

Fig. 3: Victoria Jubilee Town Hall Ground floor plan
Source: Author

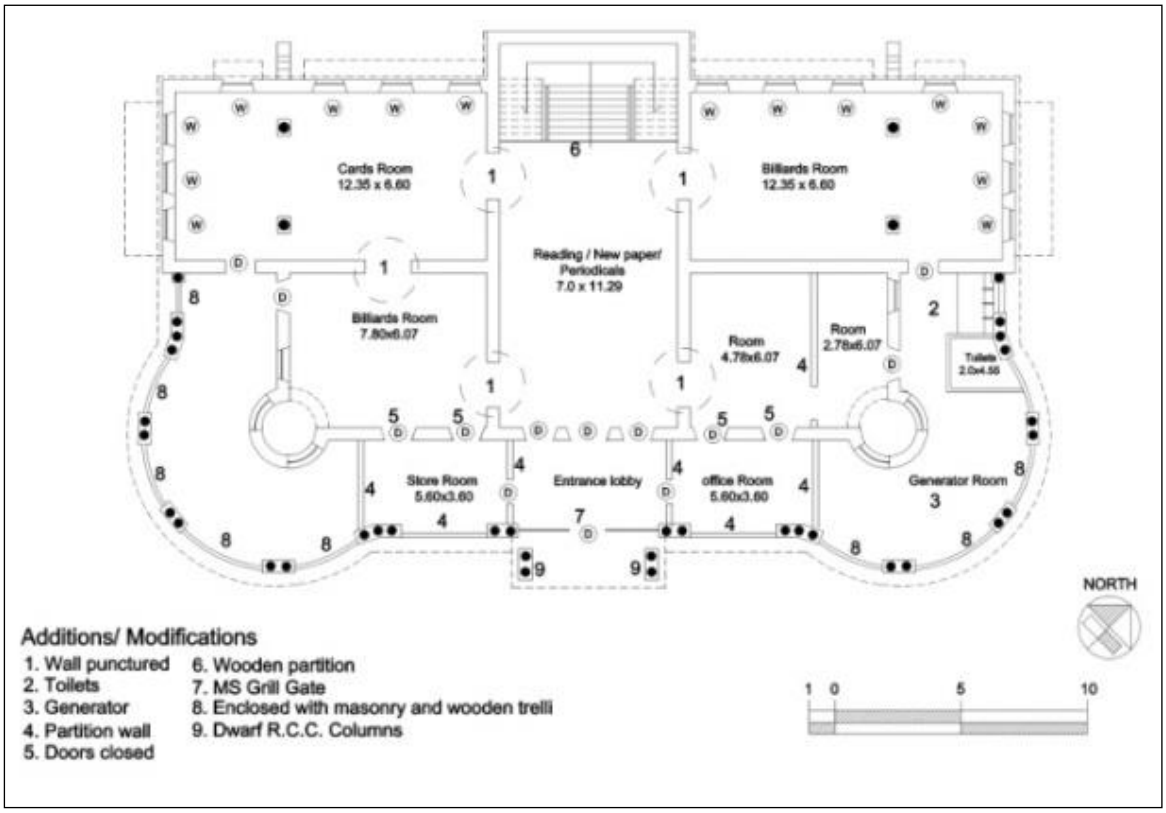

Fig. 4: Victoria Jubilee Town Hall First floor plan
Source: Author

Principal structural features such as gable roofs, overhanging eaves, turrets, and galleries make the edifice a typical example of British Colonial architecture, reflecting a simple residential plan with ground and first floors.

The Victoria Jubilee Town Hall is a fine example of construction carried out between 1901 and 1904 in a native British architectural style employing local traditional materials. The aesthetic value and architectural quality of the

environment represent a high standard of British Colonial architecture coupled with a few new features of the region. The Victoria Jubilee Town Hall, with other administrative buildings around it, is an excellent example of the English institutional ambience. use of wooden flooring as an acoustic material (in all probability), steel beams, wooden railing, and technological innovations like the creation of circular turrets as wind towers. During the time that the Municipal Council was in charge, the building was a sign of how important the province was (Kumar, 2013).

Retrofitting Works at the Victoria Jubilee Town Hall

It is observed that due to Ficus growth on the structure, extensive damage to the turrets and wooden shingle tiles over it have happened. These have been damaged or missing; the twin column base and wall on the frontside veranda of the ground floor and the stone plinth have been structurally damaged. Wooden 13 Mt. The wide truss of the grand gallery on the first floor needed to be strengthened, and damaged or rotten wooden rafters, beams, and purlin members were required to be replaced with a new one. Tile-work over leaned to the roof of first-floor verandas needs to be replaced to prevent water ingress. Madras terrace flooring cracks on the first floor are to be addressed.; The gallery around the main hall is poorly kept. The design of the wooden trellis on the windows is out of place; it should be more in sync with the wooden railing along the first floor. Electrical and lighting cables need to be placed better. Without any sensitivity towards the heritage form and architecture, the repairs in cement were carried out in first-floor overhang structure and finials; unusual window grilles and coverings with patchwork sunshades were added. Using shotcrete, epoxy resins, epoxy mortar, and gypsum cement mortar are some of the ways that problems like aging, pollution, foundation settlement, chemical weathering, and cracks can be fixed.

Case Study 2: Municipal Office Building (1933)

Historical value

It is observed that due to the growing demand, the Municipal Council has needed more area by the end of the 1930s and hence this building has been constructed at the site adjacent to the Victoria Jubilee Town Hall. It spreads across 1150 square meters in 1931 in the Fort ward of the One Town. This is the first municipal office building constructed during the British regime in the region. This structure has a striking resemblance with the local Collector's Office building, constructed between 1965 and 1914AD. This building is important in showcasing the features of an administrative character. Moreover, it displays special and rare features of the British colonial style of architecture in the region and is one of the earlier buildings where concrete was used along with Rolled Steel Joists (RSJ) as structural members. This new feature adds value to the local cultural heritage. This place has a unique connection with the local community for cultural and social reasons (Kumar, 2013).

Forms and Functions of the Building

The building is located on a widely spread hillock and adjacent to the Victoria Jubilee Town Hall, offering an excellent view of the Bay of Bengal. The construction, on axis with King Edward VII market, was made to rectangular symmetrical plan with two storey having open verandahs all around, projected wings in the four corners, and an imposing portico in the mid-front. This building was constructed to serve for local municipal administration which was constituted in the year1933 AD under Madras Municipal Act.

Proposals for Adaptive Reuse

The VJTH and Municipal Office are designated as local heritage buildings in the Visakhapatnam Metropolitan Development Authority's Master Plan for the Visakhapatnam Metropolitan Region and the Visakhapatnam Metropolitan Development Authority's City Development Plans for Visakhapatnam, respectively. The buildings were assigned Heritage grade IIA and Heritage grade III (streetscape) of by computing conservation priority ranking (Kumar, 2013).

Retrofitting

Retrofitting is the process of upgrading the load-bearing capacity of existing buildings to restore the lost strength and structural performance of the structure. Retrofitting of deteriorated RCC structural concrete members is carried out to regain their strength. The strength deficiency/damages of concrete structural members are due to ageing and adverse environmental factors such as severe cyclones, lack of cleanliness and regular maintenance, and the aggression of harmful agents. Several basic to advanced techniques have been used in the case studies to restore the strength of heritage buildings so that they could withstand seismic forces and adapt to new adaptive reuse. Structural members have been retrofitted through epoxy grouting, fiber reinforced polymer composites, sandblasting, the shotcrete method, gypsum cement mortar, and the use of epoxy mortar and resins. Many cosmetic repairs and additions have been implemented in these buildings, aiming to preserve the beauty of heritage (Awari, 2022)

Retrofitting Works at the Municipal Office Building (1933)

The structural framework is supported with steel joists and concrete beams over an exposed stone masonry superstructure. The structure is stable, neither settlement nor structural cracks have been observed in the super structure. Local cracks are observed in stonework and first-floor flooring tiles, which need to be repaired. Jaali, ventilators and windows need to be repaired, and new doors are to be fixed in place of damaged ones. The staircase leading to the terrace is partly damaged and there are observed burn marks on it. The central wooden staircase shows no signs of wear, but it must be preserved through repairs. To determine the health of the concrete structural members of the building, it needs to be verified through a non-destructive test at the site. The Epoxy Injection method has been applied to arrest structural cracks that lead to corrosion due to the ingression of water.

First-floor roof is badly deteriorated, damaged, and spoiled due to spalling of concrete and seepage of water. It needs to be rebuilt with lightweight roofing material. Internal wall plastering cracks at others. It needs to be done since it is peeling off at most of the places where there are. Flooring needs to be repaired or replaced wherever needed. There is no noticeable damage to the external facade apart from local damages caused by weed growth on some parts and weathering; the overall structural system is stable.

Fig. 5: Municipal Office Building front elevation
Source: Author

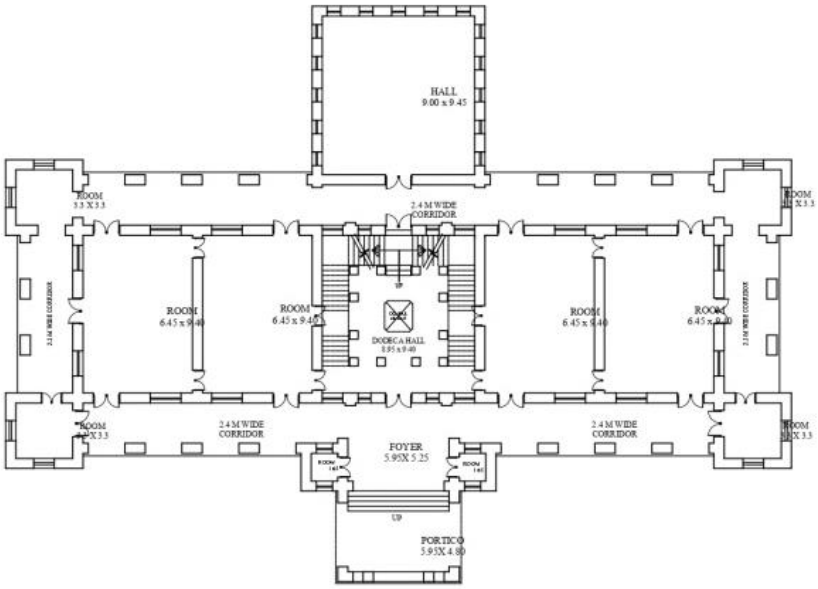

Fig. 6: Municipal Office Building ground floor plan
Source: Author

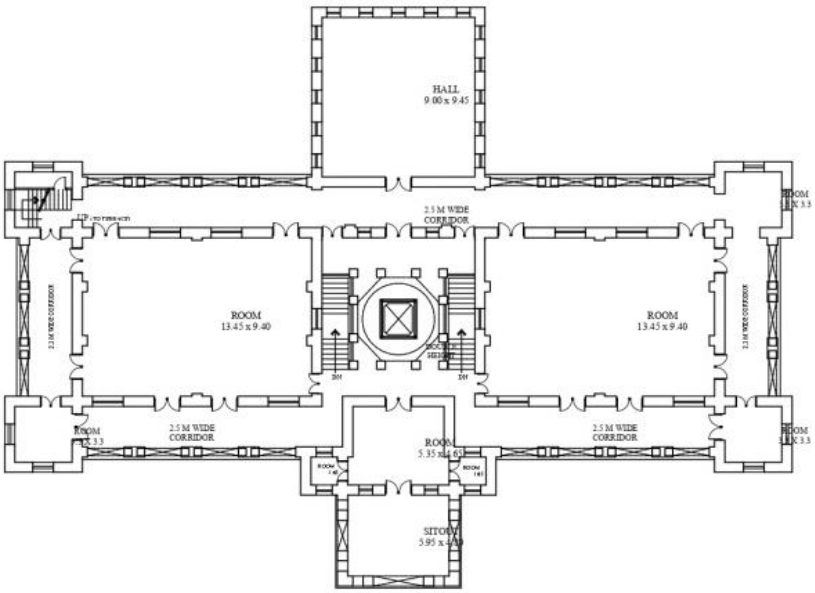

Fig. 7: Municipal Office Building first floor plan
Source: Author

Proposal for Adaptive Reuse of the Heritage Buildings: Actions Taken

As per the vulnerability and risk assessment report, the building is restored with its original structures intact, now structurally stable in all aspects by assuring an additional life span of 25years. In addition to retrofitting, it has retained its local heritage status in the Master Plan of Visakhapatnam Metropolitan Region Development Authority (VMRDA) and the City Development Plan of Greater Visakhapatnam Municipal Corporation.

As per the document mentioned in the Master Plan of VRMDA regarding heritage grade II(A) buildings in the case of retrofitting, it is only permitted to internal changes and adaptive re-use, external changes subject to scrutiny can be permitted. Retrofitting procedures in the case of the Victoria Jubilee Town Hall building have followed.

Heritage Grade III, has followed all procedures in the case of the Municipal Office building that the external and internal changes, adaptive reuse, and extensions were permitted. No new additional buildings in the same plot are permitted. Reconstruction was allowed wherever building components are structurally weak. Retrofitting procedures in the case of Municipal office buildings has followed as per the document.

Potential

Adaptive reuse provides a new purpose for an existing building by changing its capacity, function, and performance. Increasing demand for new buildings along with land scarcity results in the demolition of existing buildings. Research reveals that only 0.5–1.0% of the existing buildings require demolition while the rest are suitable after repairs, replacements, and fortification to stand for another 30–50 years and are re-used to meet the current building requirements. There are old buildings with high commercial value due to their location, and they contribute significantly to the historical and cultural aspects of their place, region, and country. Hence, adaptive reuse of buildings plays a pivotal role in regenerating the built environment and meeting the increasing demand for space, thereby preserving the prestigious historic buildings (De Silva, 2019)

These restored heritage buildings are well-preserved and ready for new users with additional lifespans. This heritage will showcase the history and culture, heritage architecture, cultural atmosphere, and heritage style of the region. The nature of the environment will support a leisure atmosphere, a natural landscape, and a safe environment. Preservation of streetscapes in the historical context and new use will benefit the regional environment. Furthermore, it will improve the existing environment and tourist attractions, which will be aided by the current tourist route's good transportation and accessibility. As per our analysis, the age of these two buildings at present is 117 and 88 years old, respectively. Following restoration, the consultants promised/assured that each heritage would have an extended life of at least 25 years or more. The majority of the heritage buildings in Visakhapatnam were in the British Colonial architectural style and character and were constructed between 1860 and 1937 AD. Thus, they are at least 85 years old. Most of them are under government control, while a few are under the control of private agencies or trusts (Kumar, 2013). Therefore, almost all heritage building sites in the hands of the government need urgent renovation. As per Silva and Perera's studies on heritage buildings, they opined that most of the buildings in the world will last for at least another hundred years. The adaptive reuse of buildings has more social, economic, and environmental benefits than any shortcomings (barriers and challenges) that need to be surmounted to improve the living conditions of people while retaining their historic importance in the regional environment (De Silva, 2019)

Discussion

Planning for proposal

Sandbhor and Botre (2013) show that adaptive reuse of architectural heritage can have a detrimental effect on the social, cultural and historic values of historic buildings, particularly where a change in the original function of a building is concerned (Sandnhor, 2013). There are two main types of adaptive reuse of buildings; "within-use" and "across-use". When a building has been adapted based on its primary use, it is a within-use adaptation, while across-use changes the initial use of the building to another use (Ellison, 2007). The local building by-laws and the zoning types influence the type of reuse, along with the physical status of the buildings, such as structural stability and the condition of the existing mechanical systems. It is also necessary to consider the historic fabric, the original building materials, the workmanship that ultimately provide character and integrity to the building, and the extent to which they should be preserved (Shehada et al., 2015). The addition of new contemporary uses to existing historic buildings must be evaluated in terms of their impact on society and the environment. Premises should be considered along with the building for its integrity, originality, and efficient protection, while a management system should be established for their wellbeing with the objective of encouraging public sensitivity, and community participation (Wang, 2010). Shen and Langston (2010) have suggested that the adaptive reuse proposal be based on the date of original construction (age), dates of subsequent major refurbishment, and forecast the physical life of the structure, with possible risk exposure on adaptive reuse (Shen, 2010).

Adaptive reuse is characterized as a shift in the use of extant heritage buildings for developing environmental, economic, and social dimensions of sustainability while taking into account asset quality, cost reduction, and real value preservation (Ragheb, 2021).

Heritage buildings are important in transferring the culture to future generations. For various reasons, heritage buildings are likely to lose their original function. Upon cessation of their original function, adaptive reuse may be the only way to preserve their heritage significance. Heritage buildings are crucial for transferring cultural identity to further generations (Gunc, 2019)

While the theoretical foundations of adaptive reuse, as elaborated by Sandbhor and Botre (2013), Ellison (2007), and Shehada et al. (2015) provide valuable insights into the challenges and considerations of repurposing heritage buildings, practical examples can offer a more tangible understanding of these principles in action. In light of this, we present several case studies that exemplify the adaptive reuse of heritage buildings, showcasing the balance between preserving cultural significance and catering to contemporary needs. These case studies, provide insights into the decision-making processes, challenges faced, and the solutions employed to ensure sustainable urban regeneration. By analyzing these real-world examples, we aim to bridge the gap between theory and practice, offering readers a comprehensive perspective on the adaptive reuse of heritage buildings.

Table -1: Status report of the heritage buildings studied
Source: Author

S.No.	Features	Categories	Victoria jubilee Town hall (Ground + 1st floor)	Municipal Office (Ground + 1st floor)
1	**Origin**	Original construction (age)	1904	1933
2	**Restoration**	Dates of subsequent major refurbishment	nil	2010
3	**Life cycle**	Forecasts physical life of the structure (expectancy)		
4	**Potential losses**	Risk exposure		

5	**Physical Aspects (Structure)**	Structural integrity	√	√
		Material durability	√	√
		Ease of Maintenance	√	√
		Design complexity	simple	simple
		Weather impacts	yes	yes
		Foundation	Not known	Not known
		Life expectancy after retrofit	>25years	>25years
6	**Economic aspepects (location)**	Population density	Medium	Medium
		Market proximity	walkable	walkable
		Transport infrastructure	adequate	adequate
		Site access	√	√
		Exposure	√	√
		planning constraints	Nil	Nil
		Plot size		
7	**Functional aspects**	Flexibility	√	√
		Spatial flow	√	√
		Convertibility	√	√
		Atria	√	√
		Structural grid	√	√
8	**Technological aspects (low energy)**	Orientation	East	East
		Glazing	x	x
		Insulation and shading	No	No
		Natural lighting	√	√
		Natural ventilation	√	√
		Building management system	To be installed	To be installed
		Solar access	√	√
		Complexity		
9	**Social aspects (sense of place)**	Image	√	√
		Aesthetics	√	√
		Surrounding landscape	√	√
		History	√	√
		Amenities		
		Human scale	√	√
		Neighbourhood	√	√
10	**Qualitative aspects (Legal)**	Standard of finish	√	√
		Fire Protection	To be installed	To be installed
		Indoor Environment	Satisfactory	Satisfactory
		Occupational Health and safety	√	√
		Security and Comfort	√	√
		Disability Access	Ground Floor Only	Ground Floor Only
		Energy Rating	x	x
		Acoustics	x	x
11	**Political aspects (context)**	Adjacent buildings	Institutional	Institutional
		Conservation	√	√
		Community interest	√	√
		Urban master plan	√	√
		Zoning	Institutional and recreational	Institutional
		Ownership	Partially Government and partially private	Government

The set of design criteria for adaptive reuse, informed by the relevant literature on existing and recent design strategies that pertain to the adaptation of heritage buildings, together with other building adaptation and sustainable design concepts and guidelines, is illustrated in the following table.

Analysis of Sustainable Design Concepts

Reuse of heritage buildings needs a high level of attention to detail to be successful (Sandnhor, 2013). In a sequel to the above, various sustainable design concepts from the local heritage environment are to be picked up to design criteria for adaptive reuse. A model questionnaire must be created while focusing on sustainable design concepts and keeping the interviewee's background in mind (Table 2). The results of this process will attract both tourists and locals, while also benefiting the heritage. Most researchers in the field stress that adaptive reuse should be viewed more holistically, integrating social, economic, environmental, urban, and political policies to achieve sustainable low carbon footprints (Kalaci, 2014). Hence, the challenges are to be listed and incorporated into the sustainability framework for adaptive reuse of the building and conservation of its heritage values, thereby enhancing its economic and social sustainability.

Table 2: Frameworks and Considerations for Heritage Structures and Urban Development
Source: Author

No.	Theoretical framework	Sub themes	Targeted outcome
1	City-based themes	Heritage architecture; Heritage style; Cultural atmosphere; History and culture, Nature of environment and regional environment	
2	Values	Architectonic and artistry, Cultural-historical values, Environmental aesthetics, Emotional experience, social context/norms, Visual versus the financial (economic) and Possible use-values	visualize the growth of the city, promoting authenticity and integrity of the heritage; learn its culture, past and present activities; memories on the city, emotions of locals; relationship in promoting heritages
3	Building Environment (Suitability)	Eco efficiency, economic viability, Energy efficiency, extending building life cycles, Retaining sense of place, Visual amenity and Value to local community	for evaluation heritages in decision making
		Accessibility of the building for disabled users, Accessibility of the building for vehicles and pedestrians as environmental value, Suitability of the new function with the building system, and new space requirements	Suitable objectives and practices for the new function
4	Sustainable development	Economic sustainability, Environmental sustainability, social sustainability, Value to local community, Orientation of building, Influence on the local economy and Ability of built to adapt.	
5	Attractiveness for adaptive heritage reuse	Reuse environment, Natural environment and regional environment	future potential of the building

In this process, the adaption of sustainable concepts will encourage tourists and locals to visualize the growth of the city and learn its culture, past pursuits, and present activities through photographic visualizations, entertainment, and achievement (growth). Preservation of positive emotions in the city gives hope for locals of a good life amidst a heritage environment (health benefit). Stakeholders' relationships in promoting heritage and their memories of the city will benefit socially. Finally, preserving culture by promoting the authenticity and integrity of heritage and landscape (inheritance) will give local tourism a sense of belonging.

All these components in the framework will definitely bring awareness to the users of the socio-cultural, economic, and physical aspects of the heritage

environment (Gunc, 2019). The idea behind this framework is not only to raise user awareness of the original function, building history, cognitive maps that show a person's point-of-view and highlights, and local environment, but also to establish the new function of the building in the district as a landmark, meeting the needs of the region by bestowing social benefits, cultural advantages, and improved quality of living conditions in the district, and elevating the overall image of the neoclassical district. Thus, adaptive reuse should be carried out without harming the architectural identity, functional and economic life cycle of a building that plays a key role in the success of a project (Sandnhor, 2013).

The adaptive reuse of heritage buildings is an intricate process requiring a multifaceted approach. While it's essential to understand the nuances of sustainable design concepts, stakeholder relationships, and socio-cultural implications, the real value lies in the application of these principles. This paper emphasizes the practical side of adaptive reuse, highlighting real-world challenges and solutions through case studies. Such an approach explains the tangible outcomes of adaptive reuse, understanding its impact on local communities, economies, and the environment.

Review of the Government Proposal

According to the case studies, the local government has advised keeping the premises as a no-vehicle zone from the residential area side and a parking zone near the Beach Road. This has involved (a) sealing the rear entry from the residential area of the historic core in axis with the commercial area, (b) converting Victoria Jubilee Town Hall into a museum reflecting Visakhapatnam's colonial history, and developing the Municipal office building as a venue for art events, exhibitions, and workshops. To make better decisions for adaptive reuse projects in settings like historic/heritage and their surroundings, researchers recommend using multi-criteria decision making and a sustainable design framework. This study used a multi-criteria strategic approach to adaptive reuse decision-making. Table 3 looks at the government proposal and ways to design for sustainability.

Table 3: Review of Government proposal on adaptive reuse
Source: Author

No.	Functional	Adaptive reuse proposals by local government	Structural integrity to suit the function	To be verified with Sustainable Design Concepts
1	Victoria Jubilee Town Hall - First floor	Planned to use as a museum that reflects the colonial history of Visakhapatnam.	Even though retrofitting is completed structurally, first floor flooring is made of wooden flanks, live loads of the large groups are to be verified.	Building environment
2	Municipal office Building	Venue for hosting art events, exhibitions and workshops.	-	1) Sustainable development and 2) Attractiveness for adaptive heritage reuse
3	Premises: rear entrance gate	The rear gate from the residential area of the historic core and axis from the commercial area is planned to seal/ close.	It loses connection with the community and residential neighborhood; visitors will not able to experience the cultural atmosphere and regional environment.	1) City-based themes and 2) Values
4	Premises: Internal zoning	Premises declared entirely as no-vehicle zone	-	Building environment
5	Parking	Suggested to keep parking on the Beach Road.	-	-

Case Study 2: Municipal Office Building (1933)

Historical Value

The Municipal Office Building, constructed in 1933, was developed in response to the growing demands of the Municipal Council. Located adjacent to the Victoria Jubilee Town Hall, it covered an area of 1150 square meters within the Fort ward of One Town. Notably, this was the first municipal office building erected during the British regime in the region. Architecturally, it bears a resemblance to the local Collector's Office building, which was built between 1965 and 1914AD. This structure is vital for highlighting features of administrative significance, showcasing the British colonial architectural style prevalent in the region. It's also among the earlier constructions where concrete and Rolled Steel Joists (RSJ) were utilized as structural elements, adding to the local cultural heritage's value. The building holds a special place in the hearts of the local community due to its cultural and social relevance.

Forms and Functions of the Building

The Municipal Office Building is situated on an expansive hillock next to the Victoria Jubilee Town Hall, offering a panoramic view of the Bay of Bengal. Structurally, it aligns with the King Edward VII market, boasting a rectangular symmetrical design spanning two stories. The building features open verandas on all sides, wings projecting from its four corners, and a central, grand portico. Its primary purpose was to serve the local municipal administration, established in 1933 under the Madras Municipal Act.

Proposal for Adaptive Reuse

Both the Victoria Jubilee Town Hall (VJTH) and the Municipal Office are recognized as local heritage edifices in the Master Plan for the Visakhapatnam Metropolitan Region and the City Development Plans for Visakhapatnam, respectively, as outlined by the Visakhapatnam Metropolitan Development Authority. Both structures have been designated with specific heritage grades, emphasizing their significance and the need for preservation.

Retrofitting

Retrofitting is described as a process geared towards enhancing the load-bearing capacity of pre-existing structures, aimed at restoring their original strength and overall structural performance. The deterioration of RCC (Reinforced Cement Concrete) structural members is attributed to various factors like aging, harmful environmental influences (e.g., severe cyclones), lack of routine maintenance, and exposure to damaging agents. The case studies employed an array of techniques, ranging from basic to advanced, to restore the structural integrity of heritage buildings. These measures ensure the buildings can resist seismic forces and are suitable for adaptive reuse. The techniques utilized include epoxy grouting, fiber-reinforced polymer composites, sandblasting, the shotcrete method, gypsum cement mortar, and the use of epoxy mortar and resins. Additionally, numerous cosmetic repairs and enhancements were made within the buildings and their surroundings by the responsible authorities, with the overarching goal of conserving their heritage appeal.

Retrofitting Works of the Municipal Office Building (1933)

This building's structural design is underpinned by steel joists and concrete beams, overlaying an exposed stone masonry superstructure. Observations indicate that the structure remains stable, with no discernible settlement or structural cracks within the superstructure. However, localized cracks in stonework and the tiles of the first-floor flooring warrant repairs. Other elements requiring attention include jaali (lattice screens), ventilators, and windows. Replacement of damaged doors, repair of a partially damaged staircase leading to the terrace (which shows burn marks), and maintenance of the central wooden staircase are also noted. To ensure the concrete structural members' health, a non-destructive test on-site is recommended. The Epoxy Injection method is highlighted as a potential solution for certain repair needs.

Condition Assessment

Specific issues were identified in the structure as follows.

- Structural cracks caused by water ingress were repaired using the Epoxy Injection method.
- The first-floor roof showed significant deterioration due to concrete spalling and water seepage. There's a recommendation for it to be rebuilt with lightweight roofing material.
- Internal wall plastering exhibited cracks and was peeling off in several areas, indicating a need for repairs.
- While the flooring required repairs or replacements in certain sections, the external facade remained largely undamaged, save for local damages due to weed growth and weathering. The overall structural system is stable.

Proposal for Adaptive Reuse of the Heritage Buildings: Actions Taken:

Based on a vulnerability and risk assessment report, the building underwent restoration while preserving its original structures. The result is a structurally stable building with an anticipated additional lifespan of 25 years. In addition to retrofitting, the building maintained its local heritage status in both the Master Plan of the Visakhapatnam Metropolitan Region Development Authority (VMRDA) and the City Development Plan of the Greater Visakhapatnam Municipal Corporation.

Regarding heritage grade II(A) buildings, as per the VMRDA Master Plan, only internal changes and adaptive re-use are allowed. External alterations can be considered but are subject to scrutiny. The procedures outlined for the Victoria Jubilee Town Hall building have been adhered to in this context.

For Heritage Grade III buildings, as in the case of the Municipal Office Building, both external and internal modifications, adaptive reuse, and extensions were permitted. However, the addition of new structures on the same plot is prohibited. Reconstruction was permitted in areas where building components were found to be structurally weak.

The content also includes figures (e.g., front elevation, ground floor plan, first floor plan) related to the Municipal Office Building, which are sourced from the author.

Potential of Adaptive Reuse

Adaptive reuse offers buildings a renewed sense of purpose by altering their capacity, function, and performance. The escalating demand for new structures combined with limited land availability often leads to the demolition of existing edifices. Studies indicate that a mere 0.5–1.0% of current buildings necessitate demolition, while the majority, post repairs, replacements, and fortification, can serve for an additional 30–50 years, aptly fulfilling contemporary building requirements. Notably, several older structures boast significant commercial value due to their prime locations, and they contribute immensely to the historical and cultural fabric of their surroundings, region, and nation at large. Consequently, the adaptive reuse of such structures plays an integral role in urban regeneration, meeting the burgeoning demand for space and simultaneously safeguarding historically significant edifices.

Restored heritage buildings, having undergone preservation efforts, stand ready to welcome new occupants and promise extended lifespans. These structures serve as testaments to the history, culture, architectural heritage, cultural ambiance, and distinct style of a particular region. They foster an environment conducive to leisure, characterized by natural landscapes and safety. Additionally, preserving streetscapes within historical contexts and repurposing them offers environmental benefits at the regional level. This, in turn, enhances the existing environment and augments tourist attractions, facilitated further by the advantageous transportation links and accessibility of the current tourist routes. The document's analysis reveals that the two buildings under consideration are currently 117 and 88 years old, respectively. After restoration, it is assured that each heritage structure will see an extended lifespan of at least 25 years or more. A significant portion of the heritage buildings in

Visakhapatnam showcase British Colonial architectural styles and characteristics and were erected between 1860 and 1937 AD.

Table 4: Saaty's Scale of Relative Importance

Alternatives	Inter weightage
Scale	**Numerical rating**
Extremely preferred	9
Very strong to extremely	8
Very strongly preferred	7
Strongly to very strongly	6
Strongly preferred	5
Moderately to strong	4
Moderately preferred	3
Equally to moderately	2
Equally preferred	1

Table 5: Sustainable design concepts analysis model for adaptive reuse (Town Hall)
Source: Author

No	Factors or criteria	Weightage (1-9) where 1 is lowest, 9 is highest	Targeted outcome
	Theoretical framework		
1	City-based themes	9	Visualize the growth of the city, promoting authenticity and integrity of the heritage; learn its culture, past and present activities; memories on the city, emotions of locals; relationship in promoting heritages
2	Values	5	For evaluation heritages in decision making
3	Building Environment (Suitability)	3	Suitable objectives and practices for the new function
4	Sustainable development	9	Future potential of the building
5	Attractiveness for adaptive heritage reuse	7	Future potential of the building

Table 6: Pairwise comparison matrix
Source: Author

Criteria	City Based Themes	Attractiveness	Values	Building Environment	Sustainable Development
City Based Themes	1	3.000	5.000	7.000	9
Attractiveness	0.333333333	1.000	5.000	5.000	7
Values	0.2	0.200	1.000	3.000	5
Building Environment	0.142857143	0.200	0.333	1.000	3
Sustainable Development	0.111111111	0.1428	0.200	0.333	1
Total	**1.787**	**4.54285**	**11.5333**	**16.3333**	**25**

In the above table.6, Ranks were given based on its importance with respect to the other factor and total of each column is calculated.

Table 7: Normalization Matrix

CRITERIA	City Based Themes	Attractiveness	Values	Building Environment	Sustainable Development	Total	Criteria Weights	Percentage Weights
City Based Themes	0.5595	0.6607	0.43365	0.4285	0.36	2.442	0.4885	48.85
Attractiveness	0.18653	0.2202	0.43365	0.30612	0.28	1.426	0.2853	28.53
Values	0.1119	0.0440	0.08673	0.183	0.2	0.6263	0.1252	12.52
Building Environment	0.0799	0.0440	0.02891	0.061	0.12	0.3341	0.0668	6.6826
Sustainable Development	0.06217	0.03146	0.01734	0.0204	0.04	0.171398	0.0342	3.4279
								100.022

In the table. 7, normalization is done for the pair wise comparison Table 6 to calculate the criteria weights and percentage weights from which we obtain eigen values.

Model calculation:

for city-based themes= Rank /total of the respective column=1/1.78=0.559

Eigen Vectors

Table 8: Table of Calculations for Eigen Vectors

CRITERIA	City Based Themes	Attractiveness	Values	Building Environment	Sustainable Development	Total	Criteria Weights	Eigen Value
City Based Themes	0.488	0.855	0.625	0.462	0.306	2.736	0.488	5.6
Attractiveness	0.16266	0.285	0.625	0.33	0.238	1.6406667	0.285	5.75
Values	0.0976	0.057	0.125	0.198	0.17	0.6476	0.125	5.18
Building Environment	0.06971	0.057	0.041667	0.066	0.102	0.336352	0.066	5.09
Sustainable Development	0.054222	0.0407	0.025	0.022	0.034	0.175938	0.034	5.17
							Total	26.79
							Thomax	5.358

In the table 8, Eigen values were obtained, for this the pairwise comparison matrix to be multiplied with respective criteria weight.

Model calculation:
for city-based themes = Rank X criteria weight of the respective row = 1 X 0.48 = 0.48

T**able.9:** Random Index (Saaty, 1990)

Numeric value	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.53	1.56	1.57	1.59

CI = (Thomax-N/N-1)
where CI= consistency index and N= number of criteria considered

CI =0.0875; N= 5
Consistency Ratio CR = CI / RI
where CR= consistency ratio and RI= Random Index
RI For 5 is 1.12 (Ref. Saaty table.9)
CR = 0.078 <0.1

Thus, the consistency ratio (CR) of the PCM is required to calculate. If the CR exceeds '0.1', the setoff decision is considered as inconsistent and it has to repeat again; if CR is absolutely '0', it means the decision is perfectly consistent (Saaty 1990, 2012).

- Considering the Pair wise comparison Matrix by taking all the required factors, the results obtained from the matrix shows us that the decisions we have taken is consistent for the adaptive reuse of Victoria Jubilee town hall. This means consideration of all sustainable design parameters will befitting to the heritage.

- The target outcomes are as follows.
  - ✓ To visualize the growth of the city, promoting authenticity and integrity of the heritage, learn its culture, past and present activities, memories on the city, emotions of locals, relationship in promoting heritages.
  - ✓ To evaluate heritages in decision making.
  - ✓ To consider suitable objectives and practices for the new function.
  - ✓ To know the future potential of the building.

Conclusion

This study on adaptive reuse of heritage buildings for sustainable urban regeneration primarily focused on two distinct case studies: Victoria Jubilee Town Hall and another whose details are not fully captured. These case studies serve as a testament to the opportunities and challenges inherent in the adaptive reuse of heritage structures.

In the case of the Victoria Jubilee Town Hall, a building of historical significance, the adaptive reuse process demands a meticulous evaluation. It's essential to weigh the structural stability, the original building materials, and the degree of preservation required. Additionally, introducing new functionalities to such a revered structure necessitates a thorough appraisal of their implications on society and the environment. This case study underscores the intricate balance between modernization and preservation, highlighting the need for informed decision-making that respects the heritage while catering to contemporary needs.

While the details of the second case study are truncated, it is evident that the adaptive reuse of heritage buildings is not just about preserving physical structures but also about safeguarding cultural identities. Such endeavours can help bridge the past with the present, ensuring that the cultural ethos is seamlessly transferred to future generations.

With respect to the research objectives:

The exploration of the Victoria Jubilee Town Hall provided insights into the city's growth while emphasizing the importance of maintaining the heritage's authenticity and integrity. The study shed light on the pivotal role of heritage evaluation in decision-making processes. The research underscored the need to identify and implement appropriate objectives and practices when infusing new functionalities into heritage structures.

Both case studies, directly or indirectly, contributed towards understanding the latent potential of heritage buildings, positioning them as assets for future urban regeneration endeavours.

In conclusion, while adaptive reuse offers a sustainable path for urban regeneration, it's crucial that such efforts are rooted in comprehensive research and respect for the heritage they seek to rejuvenate. The case studies presented offer valuable insights into the nuances of this intricate process and underscore the importance of a balanced approach that tie the knot preservation with innovation.

Limitations

While adding creativity and flexibility to the building, stakeholders and planning authorities should understand, physical limitations such as structural constraints, aesthetic appeal, architectural and historical features that may make fit a heritage building to a new use but some other aspects may remain challenging. Local governmental regulations may become constraints to the proposed reuse. Existing structures may be in pre-dated zoning that limits uses and restricts possible reuse opportunities. Other development regulations can also be challenging for permitting building conservation and restoration to meet modern requirements.

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