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Climate 'induced' Deterioration Aspects of Manjarabad Fort with Remedial 'site-specific' Restoration Measures

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***Abstract**: Structural Restoration of Historical Monuments is one of the key facets of Urbanization from Tourism point of view. The present study proposes a site-specific restoration methodology for "Manjarabad Fort", a historical monument constructed during the regime of Tippu Sultan. Regrettably it is conserved very badly; in spite of A.S.I. identifying it as one of the Heritage structures. The approach followed in this case-study envisages photographic, technical, physical and historical survey. The vegetation on all the walls and grounds of the fort paraded signs of degradation necessitating immediate upkeep. The fact that the fort has its own unique architecture ethically mandates that the conservation should be prioritized without altering it. The techniques of restoration encompass clearance of vegetation about the walls, checking the physical supports for leakages and dampness; as the fort is located in a region popular for thick rainfall during monsoon. The restoration also necessitates removal of ground undulations to avoid stagnant water which may increase the dampness in walls and foundation. Also the study found that the high velocity wind of the region has triggered removal and weathering of top most layer stones of the fort walls. This ought to be rectified with substitution of the stone blocks found in fort grounds. While the wholly dented architectural part needs to be rebuilt using white cement and clay; the partially decayed and completely displaced components of the structure ought to be identified and accordingly conserved. As the structural safety is of utmost important the fort inner walls, slab and beams were also inspected for the major cracks and minor concrete cracks, which should be shielded with the mortar.*

***Keywords**: Manjarabad; Fort; Tippu; Structural; Urbanisation; Restoration;*

I. Introduction

Urban development and planning take a variety of forms including strategic plans, comprehensive plans, neighbourhood plans, regulatory or incentive strategies, and historic preservation plans [1]. The present paper describes about the importance of conservation of historic monuments as one of the important element of urbanization with a case study. Tippu Sultan (Ruler of erstwhile state of Mysore) engaged the construction of Manjarabad Fort in 1785 with French Architecture atop a mountain that commanded the present Mangalore-Bangalore highway, which would then be the likely avenue of approach for a concerted East India Company (British) attack. The fort was completed in 1792 [2].

Figure 1: Satellite image of Manjarabad Fort.

As a defence strategy to guard the approaches to Mangalore and Coorg, the bastions were constructed pointing in all the eight directions shaped like arrow-heads. Consequently the fort took the shape of an eight-pointed star (Figure 1). The Fort is constructed of granite and rubble, and protected by trenches all around [2]. In spite of having a rich history, the fort remains as an exempted and least conserved monument from A.S.I. The vegetation on all the walls and grounds of the fort both inside and outside displays all signs of degradation, thereby demanding immediate conservation

II. Experimental Methodology

The present study proposes a site-specific restoration methodology for "Manjarabad Fort", a tangible heritage structure based on the photographic, technical, physical and historical survey. The study envisaged detection for presence of vegetation, dampness, ground undulations, wind profile, air quality and structural safety aspects.

III. Results And Discussion

The study found that the granite rocks had been used for the construction of fort and that the courses were of different sizes. The major problem faced by the fort was essentially due to negligence of A.S.I. authorities in the form of zero maintenance.

Figure 2: Vegetation growth on the Fort ground.

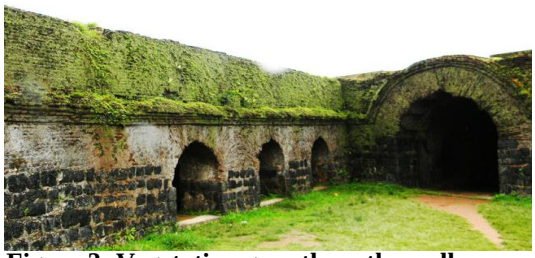

Figure 3: Vegetation growth on the wall.

The major damages were introduced by accelerated unchecked growth of plants on the ground (Figure 2 and lichens on the walls (Figure 3). Primarily remedial and corrective action must engage vegetation clearance about the external surfaces (Figure 4) and on the internal surfaces (Figure 5), without damaging the structure of the fort. Also it is observed that the lichens and vegetation growths in the joints (Figure 5) of the stone masonry have created weak joints and several gaps. Also in order to retain the authenticity clay/sand mortar can be used to fill the gaps, as a mode of replacement or retouching of the missing parts.

Figure 4: Vegetation on Fort's external surfaces.

Figure 5: Vegetation on Fort's internal surfaces.

Figure 6: Vegetation growth in crevices/gaps.

Figure 7: Weathering action by Wind.

The high velocity winds in the region have also caused the shifting and erosion of topmost layer stone of the fort walls along the wind direction (Figures 7 and 8). This can be mended if stone blocks found in fort grounds and additional blocks of the same texture are used for remaining span. In this context, sadly, most of the external and internal walls of the fort are was found to be damaged by graffiti (Figures 8 and 9). This can be addressed by gentle abrasive and heat treatment methods. At the same time, summer can aggravate natural fires due to the presence of dried vegetation about the vicinity of Fort (Figure 10) which can again tarnish the surfaces and historical engravings on the monument, hence again necessitating timely removal of weeds and vegetation.

Figure 8: Damage due to Wind and Graffiti.

Figure 9: Graffiti and defacing of the walls.

The protrudes of walls are more susceptible to climate change and therefore the damaged elements needs to be plastered. Further, partially decayed and completely displaced components of the structure ought to be identified and conserved. The conservation ought to be done without altering the French architecture of the fort, and the fully damaged architectural parts may be rebuilt using white cement and clay. As the fort is situated in Malnad, a region which receives heavy rainfall during monsoon; hence the physical structures of the fort such as walls, slab, arches and beams ought to be periodically checked for leakages and dampness. In lieu of rainfall, the existing ground undulations must be removed to avoid stagnant water which may aggravate built-up of the dampness in walls and foundation. Due to the seasonal temperature variations, the walls and roof are subjected to expansion and contraction, hence they must be suitably water proofed.

Figure 10: Dried vegetation in the vicinity of Fort.

Figure 11: Dampness in the vicinity of Fort.

When study was established for **structural** safety and stability of the structure (w.r.t. cracks for inner fort walls, slab and beams), no major cracks or deflection of the beams were observed; and each component of the building was observed to be thankfully sound. However, only certain weakened structural joints have been identified and to address this, the minor concrete cracks must be covered with the mortar. Also spray or brush protective films or water repellents ought to be applied on stone affected by chemical integration and biological attacks. Common protectants include waxes, acrylic and silicon resins. The solitary major problem to the fort walls is dampness (Figure 11), which should be prevented by providing a water proof layer at the foundation level upto 0.25m high above the ground level.

IV. Conclusion

The present study proposed a site-specific restoration methodology for "Manjarabad Fort". The major damages includes defacing of the monument walls, seepage into the structure upon monsoon, accelerated unchecked growth of plants on the ground and lichens on the walls; and wind/climate weathered deterioration of the topmost courses of masonry and entablature. From the structural safety point of view for beams the study revealed no major cracks and deflection. The techniques of restoration encompassed vegetation clearance, examination for the leakages and dampness about the physical supports, removal of ground undulations, substitution of the stone blocks for topmost layer stones, rebuilding fully damaged architectural part using white cement and clay; conserving partially decayed and completely displaced components of the structure.

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