Journal of Engineering and Applied Sciences 12 (8): 2004-2008, 2017
ISSN: 1816-949X

Analyzing the Effect of Preventive Maintenance Management in Treatment Process of Historical Buildings of Iran

[1]Safoura Rouhi, [2]Nima Vali and [2]Gholamreza Kiyani Dehkiyani
[1]Depertment of Art, [2]Department of Building Estoration, Faculty of Restortion,
Isfahan art University, Isfhan, Iran

Abstract: Many of historical buildings are gradually ruining now a days without having preventive maintenance management. Maintaining historical buildings requires much cost as in medical therapy the prevention costs significantly less than therapy. Preventive maintenance directly can make the treatment process of historical building conditional. Other researchers have more noticed industrial affairs in the field of preventive maintenance. This study for the first time tries to investigate the process of preventive management in treatment of historical buildings. This research has been based on library data. After investigating and studying the samples of cures in developed countries, solutions after localization for historical buildings in Iran will be stated through proposing checklists. This study sought to propose how preventive management is used in historical buildings. Analyzing the function of preventive maintenance in historical buildings will lead to increasing the life of historical buildings, decreasing the cost of repairing historical buildings, spending less time and having an information reference of historical buildings.

Key words: Preventive maintenance management, historical buildings, treatment process, monitoring checklists, Iran

INTRODUCTION

Maintaining the capitals of the country and evaluation of cultural heritage assets on one hand and rapid progress of destruction and increasing new tourists in the country on the other hand have obliged using in time preventive maintenance in historical buildings. Lack of using preventive maintenance method will cause the destruction of historical properties of Iran. Suing the plan of timing and appropriate programming for vising the buildings the damages can be diagnosed before occurrence as result the costs caused by repairing will significantly decrease. Preventive maintenance method prevents wasting time to the great extent. In many cases damages create some changes in historical buildings which cannot be compensated.

The abundance of historical buildings in Iran clearly shows needing a new attitude toward their treatment methods. These methods now a days are based on treatment after damage which includes two sections of repairing created damages and reviving and reusing these buildings. Using solutions that can prevent the damages before their occurrence will cause not only the remained values in historical buildings get guarded but also it can economically help to maintain these buildings. How preventive maintenance can affect controlling the damages in historical buildings? What is the process of preventive maintenance in controlling the damages in historical buildings? How preventive management process in industry can be a pattern for repairing historical buildings? This study sought to propose some solution in order to respond these questions through getting pattern from industry.

Literature review: The vital and strategic importance of maintaining and restorations in different industries gets increasingly prominent. Therefore, whatever the maintenance and restorations improve more effectively, it can have desired dual effect on increasing the rate of economic productivity as follows:

- Through increasing the efficiency of equipment it caused increasing the revenue
- Through reducing the need to new capital and in another word devaluation of assets it led to ROA (Return on Assets) increase

Preventive maintenance and restorations were discussed by Japanese people in 60s of 20th century

Corresponding Author: Safoura Rouhi, Depertment of Art, Isfahan Art University, Isfahan, Iran

through the experiences which that had obtained in the field of maintaining and repairing during 50s of 20th century in the USA. Some researchers (Tavakoli, 2006; Hosseini, 2004) have emphasized on using preventive maintenance program which includes regular and predicted restorations and this method is greatly similar to the human life in which through doing health orders the diseases can be prevented. Maintenance and restorations are divided into four main categories: predicted repairs, emergency repairs, reforming repairs, predicting the restorations (Tavakoli, 2006). The activities of preventive maintaining and repairing are accomplished to reduce possible failures and varies based on the type of used technology in producing its volume and time of activity. Planning maintenance and restorations include all activities which are conducted by manager to provide future affairs and ensure correct accomplishment of production technology tasks. Other researchers (Feilden, 2015; Barandi, 2009) also believe that maintenance and restorations are considered as today human knowledge and science. This method can be used to maintain historical buildings. All units should be obliged to have technical archive and information bank to be able to analyze the process of maintaining and repairing regularly. Maintenance and education should be linked together.

MATERIALS AND METHODS

Damaged historical buildings can be studies in this section as case study. After library studies, some solutions by which preventive management of industry can be used as some patterns in repairing historical buildings will be proposed. In this process, the conditions related to historical buildings and related rules to it have been considered as a principle and preventive management is tried to be proposed for these buildings so that it creates the minimum inference with existing values in historical buildings.

RESULTS AND DISCUSSION

Body: Within past 20 years, maintenance and restorations have been changed a lot. That is because increasing the number and variety (buildings and equipment) that have to be maintained and repaired all around the world. The personnel of maintenance and restorations as well as managers and engineers should completely adapt with new methods of thinking and operations (Moubari, 2010).

The history of maintenance and repairs: Since 1930 up to now, the development and changes of maintenance can be divided into three main periods: first generation it is the period before the second world war. On those days, the industry hasn't become fully machined and as result stop time wasn't that much important which means that preventing the damage of equipment wasn't very important for managers (Moubari, 2010). Second generation everything changed hierarchal during second world war. This led to the creation of the thinking of system damage should be prevented which led to the concept of preventive maintenance. In 1960s, this concept used to include more doing main restorations on equipment in fixed time interval. Gradual increase of restorations compared to the cost of other activities also caused the growth of planning and controlling maintenance systems (Moubari, 2010). Third generation was since the middle of 1970s, changing process in the industry accelerated more. These changes can be categorized under the titles of expectations, researches and new techniques (Moubari, 2010).

Preventive maintenance in historical buildings: According to proposed definition in international institute for the conservation of America, preventive maintenance is reducing the destruction and damage to cultural assets through setting and using the principles and methods which have been necessary for all activities of a building and can be effective on maintenance site and the complex (Abdolmaleki and Ahmadi, 2014). Canadian group of International Institute for the Conservation (IIC) has defined preventive maintenance as all activities which are conducted for controlling the process of destruction and avoiding the damage of cultural works which is through providing the best conditions of maintenance (light, relative humidity, temperature, environmental gases), security, storage, management and the power of facing emergency conditions in different sections of museum through developing instructions and performing its strategic (Andro, 2009). Preventive maintenance is lack of interventional activities to prevent damage and minimize the destruction in a historical building (Abdolmaleki and Ahmadi, 2014). Prevention is the highest type of protection. If erosion factors are eliminated or at least are reduced then we will have obtained a significant goal. The resources of air pollution and disturbing noises of vehicles can be reduced or eliminated through governmental measures and urban planning. Maintenance and prevention against dangers and natural disasters can be used for reducing the damages of cultural resources.

Administrative steps and practicing how to cope with disasters reduce confusion while the accidents occur and lead to experimented and appropriate programs (Feilden and Youkilto, 2003). Prevention includes protecting cultural asset or controlling its environment, therefore it protects erosion and damage factors. Ignorance should be also avoided through correct methods of caring based on regular inspection. Therefore, prevention includes controlling light, temperature and internal humidity as well as some measures to prevent firing, deliberate arson, robbery and destructing cultural works. Land subsidence should be also controlled this subsidence is derived from many factors such as water (Fielden, 2015).

The goals of maintenance and repair are common either in historical buildings or industry. The goal of establishing PM in a system is reducing hidden costs in that system that as result will lead to increase workforce, decrease environmental threats and decrease operational costs and reducing the used time. In order to achieve this aim an effective PM program should be implemented to reduce the damages and destructions whether in industry or historical buildings.

Moreover, preventive protection leads to developing tourism industry in the country. Historical buildings attract tourists (Shoun, 2012). The goal of maintenance policy of a building is ensuring its constant use in desired level of users. This level should be considered carefully because achieving that requires a wide range of maintenance measures, from the measures such as preventing the damage caused by wind and climate to providing the conditions of using building eagerly with safety and precautionary measures to deal with fires (Fielden, 2015).

Regular inspection should be accomplished by employees in particular levels appropriate with their abilities and so become a very professional inspection that is conducted in time interval of less than every 5 years (Berandi, 2009).

Though each historical building is small it needs a local janitor who is responsible for investigating it internally, externally and all around it in all climate conditions and noting the shortcomings. After each severe rainfall or wind he has to inspect and note his observation in a notebook. If a janitor is able to guide protection masters to do immediate initial repairs, useless delays and costs can be reduced. Historical buildings are always eroding. Repairing after a damage is very wrong so they have to be visited regularly.

The levels of preventive maintenance: Improving the program of maintenance and restorations management is a continues process which requires continues interest and active participation. A nine-level approach for managing maintenance program effectively has been proposed as follows.

Identifying existing short comings: This can be realized through interviewing the personnel of maintaining and repairing and using the indexes of internal performance.

Determining the goals of maintenance and repairs: These goals consider existing shortcomings and show ultimate goals of improvement.

Determining the priorities: The projects of maintaining and repairing should be listed respectively according to obtained savings or competences.

Defining performance measuring parameters: For each set of goals a quantitative criterion should be defined. For example, the number of completed works in the week and the percentage of repairing cost.

Defining short-term and long-term programs: Short-term programs concentrate on the goals which have the highest priority and are usually within a 1 year period. Long-term programs have been more strategic naturally and specify valuable goals that should be realized within three to 5 following years. Documenting short-term and long-term programs. Implementing determined programs.

Reporting the status: A summarized report should be prepared periodically for example every 6 months and given to all related people. Mentioned report should contain some information about real values of deviating from timing program and related reasons about each one of specified goals in short-term program.

Determining the amount of annual progress: Having maintenance program the rate of progress can be observed and the process of program can be followed. At the end of each years the rate of progress should be investigated based on determined goals. Considering specified goals in long-term program and doing necessary modifications in the program of previous years (timing, resources, expenses and so on), a short-term program should be determined for following years (Fadaei and Hosseinin, 2014).

The achievements of preventive maintenance: More environmental safety and health: if historical buildings aren't inspected they might have unsafe function and expose the people who work there to danger. Doing these inspections is a vital issue. Most of workers tend to ensure the safety of equipment and know if this equipment hurt them and put them in the risk of death. In practice, most of safety dangers will be discussed as damage modes in later levels but in some cases the description of functions which relate to specific threats and safety is necessary to be also stated. Many of facilities have secondary structural function.

For example, initial function of a wall in a building may be protecting people and facilities against bad climate but the wall might be expected to keep the ceiling (and tolerating the weight of shelfs and frames) (Moubari, 2010). More effectiveness for maintenance costs: When you have a specific and developed program, you can determine specific costs for specific parts and prevent wasting the costs. The contractors can also spend more costs than specific ones. This issue helps us to ensure all is being spent on maintenance has been spent on the best possible thing (Moubari, 2010).

Spending less time: When the timing of works is clear it will lead to have exact timing to be able to do works based on appropriate timing. The volume of timed work will be absolutely less than when the program is created using traditional methods.

More useful life: When inspections and preventive maintenance are regularly implemented we will ensure that what condition has the structure and then the life of historical monument will increase.

A comprehensive information database: Through having checklists and the method of developin, a preventive maintenance investigation will ultimately cause the organization to have comprehensive and completely real documents from the requirements of maintaining all necessary parts. Investigating preventive maintenance also provide a very transparent attitude about the requirements of maintaining required equipment. Improved maps and instructions are secondary results.

More motivation in people: The existence of strategic programs and specification of expert' s tasks to do this strategy will motivate them to advance this program and coordinate in preventive maintenance. Especially those who had been participating in investigation process. This subject will lead to better public understanding of system in their work conditions and also create more sense of belonging to the problems of PM and their solutions and will cause more continuity of proposed solutions.

Better team work: Preventive maintenance will lead to creation of a common and perceivable technical language for all people involved in maintenance problems. This will cause the personnel of PM to get better perception from what the maintenance can achieve (and can't) as well as what they have to do to achieve that.

Summarizing: Prevention is the highest type of protection. If erosion factors are eliminated or at least are reduced then we will have obtained a significant goal. The resources of air pollution and disturbing noises of vehicles can be reduced or eliminated through governmental measures and urban planning. Prevention includes protecting cultural asset or controlling its environment, therefore it prevents the factors of erosion and damage. The improvement of maintenance management is a continues process which requires a continues interest and active participation.

CONCLUSION

Through having an exact and regular program, preventive maintenance can prevent the advance of created damages just in time. Considering the importance that historical buildings have they need to use reliable methods and predetermined programming. Preventive maintenance was first used by Japanese people and Americans to reduce the damages and increase the efficiency in industry. But over time they figured out the importance of preventive maintenance therefore it was used in historical buildings to maintain these works. Preventive maintenance is an undeniable and vital issue for historical buildings, so preventive maintenance was introduced and investigated.

APPENDIX

The questionnaire of managers for evaluating preventive maintenance program: The formation of research and development of the USA has developed a study on relevant subjects to maintenance management and raised following 10 questions for maintenance managers to be able to evaluate their attempts. Table 1 proposes 17 questions to determine the competency of a preventive maintenance program inside an organization. Answer "yes" or "no" to each question will, respectively score 5 or zero. "To a certain extent" will get 1-4 scores. In case total sum of scores is <55, it indicates that preventive maintenance program need more improvement (Fadaei amd Hosseini, 2014). If you answer each one of questions bottom yes, it shows that your maintenance program is going well toward realizing organizational goals. Otherwise appropriate modification measures are required (Fadaei and Hosseini, 2014).

Table 1: The questionnaire of managers to evaluate preventive maintenance

Questions	Answers: Yes 5 scores	To a certain extent 1-4 scores	No 0 scores
Is the trend of stops recorded and reported regularly?			
Is there an official program of preventive maintenance?			
Do inspectors their inspection duties full time?			
Are there checklists for ensuring 100% accordance?			
Are the routes of inspection are scheduled based on work measuring methods?			
Are inspection reports controlled by related supervisor to measure their accuracy?			
What percent of stops are because of maintenance?	>8%	<8%	Unclear
Are the tasks done based on scheduled checklists?			
Does maintenance management receive appropriate reports about stops?			
Is there any one to be responsible for preventive maintenance?			
Are lubrication routes defined and scheduled based on work and time measurement studies?			
Is data processing used for scheduling and reporting inspections of preventive maintenance?			
Are predictable problems identified and reported immediately by preventive maintenance inspectors?			
Have the affairs of preventive maintenance defined in reporting system to be able to have update analysis of preventive maintenance as a separated level of current expenses?			
Are the requirements investigated regularly?			
Are the reports of damages analysed for identifying the pattern of damages to be able to eliminate them through moderating preventive maintenance programs?			
Are constructional assets and machineries inspected regularly as one of inseparable parts of inspection program?			

REFERENCES

Abdolmaleki, M.D. and H. Ahmadi, 2014. Comprehensive Management of Preventive Protection Against Pests in Museums. Sherlyn Publishing, Tehran, Iran.

Andro, 2009. Preservation and restoration cultural heritage. IIC (International Institute for the Conservation, Canada.

Barandi, C., 2014. Restoration Theory (Theory of Restoration). Tehran University, Tehran, Iran.

Fadaei and M. Hosseini, 2014. Modern Approach to Maintenance. Jihad Publication, Tehran, Iran.

Feilden, B. and Y.Y.M. Bernard, 2003. Management guidelines in the area of cultural heritage. Iranian Cultural Heritage Organization, Tehran, Iran.

Feilden, B.B.M., 2015. Protection of Monuments. Tahan Publications, Tehran, Iran.

Hosseini, D.M., 2014. Systematic Planning of Maintenance and Service Sector Industries. Industrial Management Institute, Tehran, Iran.

Moubari, J., 2010. Reliability-Based Maintenance. Ariana Publishing, Tehran, Iran.

Shoun, 2012. Guidelines for exterior maintenance and alterations. Office of Historic Preservation, San Antonio, Texas.

Tavakoli, H., 2006. (TPM) Maintenance of interest. Saipa, South Africa.