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A Review on Structural Audit, Repair and Rehabilitation of Building

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ABSTRACT: Structural Audit is a technical survey of an engineering structure to assess its health. Evaluation of current vague practices of Structural Audit paved way to understand the drawbacks of those processes and modify the same for methodical implementation of Structural Audit. This research aims at understanding the drawbacks if any in the current procedure, recast the structural auditing process and propose some improvement measures to the governing body. Structural audit is the technical survey of the building in order to check its strength and stability. Structural audit is the first step in repairing procedure of the building. Structural audit is generally recommended for older buildings. Structural audit was first introduced by Indian society of structural engineers. Structural audit helps in improving the safety, efficiency and gives idea about the strength of the structure by detailed technical inspection. In present study attempt have been made to carry out structural audit of the old RCC building by carrying out site inspection, performing NDT on the structure. Building is modeled and analyzed using ETABS and Demand to capacity ratio is determined. After checking strength and stability of the structural members suitable recommendations are given in order to retrofit unsafe structural component. Finally structural audit report is prepared for the building. This paper also deals with the repair rehabilitation measures that are to be enacted after the Audit and prepare an advanced operating procedure for Structural Audits.

KEYWORDS:-Structural Audit, Non-Destructive Test, Repair, Rehabilitation.

I. INTRODUCTION

Structural audit is the overall health and performance checkup of the building like doctor check the patient. Structural audit helps to understand the status of the old building. The Audit helps to highlight & investigate all the risk areas, critical areas and whether the building needs immediate attention. It cover the structural analysis of the existing frame and highlight the weak structural areas for static, wind & earthquake loads. If the bldg. has changed the user, from residential to commercial or industrial, this should bring out the impact of such a changerecent years witnessed the boom of construction sector in MH. In cities like Mumbai, Pune and Delhi urbanization has started very long before, such that now the buildings are aged. Thus there are many structures that have reduced strength in due course of time. It may endanger the life of people who are living inside those buildings. In such a case appropriate actions should be proposed and implemented to improve the performance of structures and restore the desired function of these buildings. There came up the importance to perform structural audit of existing buildings and to put forward maintenance/ repair work timely which will lead to prolonged life of the building and safety of the occupant. Structural Audit of a building is the preliminary technical survey [3] to assess its general health as a civil engineering structure. With the study of current process of Structural Audit there is a need to find the lacks of the current processes and advancing the process for efficient implementation of Structural Audit on present day structures.

1.1 Background

The need of structural audit is for maintenance and repairs of existing structures whose life has exceeded the age of 30 years to avoid any mishaps and save valuable human life. The concrete is widely used as construction material being

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inexpensive, easy for construction, applications and because of its high strength-cost ratio. More than ever, the construction industry is concerned with improving the social, economic and environmental parameters of sustainability. In India, from 1980 onwards the infrastructure industry witnessed stepping up of public investment and growth in infrastructure industry which results in construction of new multi-storey concrete apartments which are now in the age of thirty plus years. There are many buildings during this period and earlier have reduced strength in due course of time because of structural deficiency, material deterioration, unexpected over loadings or physical damage. If, further use of such deteriorated structure is continued it may endanger the lives of occupants and surrounding habitation. There is demand of appropriate actions and measures for all such building structures to improve its performance and restore the desired functions of structures which may lead to increase its functional life. The periodical structural auditing and diagnosis for health of existing buildings is thus utmost important for finding the present serviceability and structural viability of structures. The structural audit must be carried out following auditing norms, methods of non-destructive testing and code provisions. The structural auditing will help to implement maintenance and repair work timely which leads to prolonged life of the building and safety of the occupants.

1.2 Motivation

In India there are many old buildings which have reduced strength in due course of time. If further use of such deteriorated structure is continued it may endanger the lives of the occupants and surrounding habitation. Appropriate actions should then be implemented to improve the performance of structures and restore the desired function of structures. Thus, it is utmost important to perform structural audit of existing buildings and to implement maintenance/repair work timely which will lead to prolonged life of the building and safety of the occupant. To act more responsibly and pre-emptively towards the dilapidated buildings, the municipal corporation must issue notices to the buildings and co-operative societies which are more than 30 years old to carry out mandatory structural audit and submit the audit report. Structural audit should highlight and investigate all critical areas and recommend immediate remedial and preventive measures. It should cover the structural analysis of existing frame and find critical elements for all types of loadings. It also helps in delivering a strong building structure with cost-effective solutions and appropriate maintenance programs. This paper deals with study of different parameters of structural audit including visual inspection, non-destructive testing, core sampling and testing. It also emphasizes on different repairs and retrofitting measures to be used for buildings after structural audit.

Structural Audit is an overall health and performance check-up of a building like a doctor examines a patient. It ensures that the building and its premises are safe and have no risk. It analyses and suggests appropriate repairs and retrofitting measures required for the buildings to perform better in its service life. Structural audit is done by an experienced and licensed structural consultant.

1.3 Need for Structural Audit

1. To increase life of property
2. To know the health of building and its expected life.
3. To check actual reliability of the structure.
4. In order to recommend rehabilitation techniques.
5. In order to highlight the critical areas and repair them immediately.
6. For structural audit certificate required by municipality and other authorities.

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II. LITERATURE REVIEW

1. Patil S.R., Prof. Sayyed G.A” Structural Audit ”IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN : 2278-1684, p-ISSN : 2320–334X PP 60-64

From this Paper I Refer-

Civil Engineering Industry is one of the oldest industries which provide a basic infrastructure to all the human beings. Structures can be any kind it can be Historical, Heritage Structure, Residential building, Commercial building or an Industrial building. Every structure has its own service life, and within this service life it should stand firmly on its position. Ex- ATajMahal in Agra in India which is one of the oldest structure and a Wonders of the World, and still stand on its position very efficiently. But this not a condition about the today’s Structures. A collapsed mechanism has increased and today’s Structures are getting collapsed before there service life is completed. Therefore, it is advisable to monitor it periodically by taking a professional opinion. Structural Audit is a preliminary technical survey of a building to assess its general health as a civil engineering structure. It is usually initiated as the first step for repair. In this Project a Root Cause of a faulty mechanism of structure and a preventive measures to overcome a failure of this structures. [1]

2. BHAVAR DADASAHEB “Retrofitting of Existing RCC Buildings by Method of Jacketing” Vol. 1, Issue: 5, June: 2013 (IJRMEET) ISSN: 2320-6586

From this Paper I Refer-

Many parts of the country have suffered earthquake in last three decades. In costal part of South India faced Tsunami. In first three earthquakes it was found that many of damaged structures were build in non-engineered masonry techniques. Unreinforced masonry structures are the most vulnerable during an earthquake. Normally they are designed for vertical loads and since masonry has adequate compressive strength, the structures behave well as long as the loads are vertical. When such a masonry structure is subjected to lateral inertial loads during an earthquake, the walls develop shear and flexural stresses. The strength of masonry under these conditions often depends on the bond between brick and mortar (or stone and mortar), which is quite poor. This bond is also often very poor when lime mortars or mud mortars are used. A masonry wall can also undergo failure in-plane shear, if the inertial forces are in the plane of the wall. Shear failure in the form of diagonal cracks is observed due to this. However, catastrophic collapses take place when the wall experiences out-of-plane flexure. This can bring down a roof and cause more damage. Masonry buildings with light roofs such as tiled roofs are more vulnerable to out-of-plane vibrations since the top edge can undergo large deformations. It is always useful to investigate the behavior of masonry buildings after an earthquake, so as to identify any inadequacies in earthquake resistant design. Studying types of masonry construction, their performance and failure patterns helps in improving the design and detailing aspects.

3. P. B. Oni “Performance Based Evaluation of Shear Walled RCC Building by Pushover Analysis” International Journal of Modern Engineering Research (IJMER)

From this Paper I Refer-

As the world move towards the implementation of Performance Based Engineering philosophies in seismic design of Civil Engineering structures, new seismic design provisions require Structural Engineers to perform both linear and nonlinear analysis for the design of structures. In the present work three storey and six storey building models with plus shape Shear wall have been considered. Equivalent static and response spectrum methods are carried out as per IS:1893 (Part 1) -2002 using finite element analysis software ETABS v9.1.1. Seismic performance is assessed by pushover analysis as per ATC-40 guidelines for earthquake zone V in India. The paper also deals with the effect of the variation of the building height on the structural response of the shear wall. This paper highlights the accuracy of Push over analysis in comparison with the most commonly adopted Response Spectrum Analysis and Equivalent Static Analysis.

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4. Krish R. Villaitramani” PREFABRICATED CONSTRUCTION FOR MASS HOUSING IN MUMBAI” International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163 Volume 1 Issue 9 (October 2014)

From this Paper I Refer-

Urbanization is the rapid influx of people migrating to cities. The UN has predicted that by 2050, 64.1% and 85.9% of the developing and developed world respectively will be urbanized. With limited resources of labour, time and finance, slums around the world continue to grow in size in uninhabitable conditions for humans. Prefabrication of houses, an innovation that has potential to address environmental and sustainability concerns at a rapid pace, mechanizes the construction process, enabling mass manufacture of affordable houses. This paper discusses the case of Mumbai, the city of maximum slum population density in the world, where prefabrication can be a promising solution to housing scarcity.

5. Guney OZCEBE “REHABILITATION OF EXISTING REINFORCED CONCRETE STRUCTURES USING CFRP FABRICS” 13th World Conference on Earthquake Engineering Vancouver, B.C., Canada August 1-6, 2004 Paper No. 1393

From this Paper I Refer-

Intensive experimental research carried out for decades showed that strengthening of reinforced concrete (R/C) frames by introducing R/C infills to the selected bays in both directions is an effective method for the rehabilitation of damaged structures. However, this procedure requires evacuation of the building for several months; therefore its applicability in the rehabilitation of the existing structures, which are currently in use, is neither feasible nor practical. Observations of poor building performance after the recent earthquakes in Turkey and elsewhere and the enormous existing building stocks necessitate urgent development of innovative strengthening techniques, which would not interrupt the use of the building during rehabilitation. An experimental study was initiated at the METU Structural Mechanics Laboratory, which aimed to develop such strengthening techniques. In this study, it was intended to convert the nonload bearing existing masonry walls and partitions into structural elements which would form a new lateral load resisting system by strengthening them with CFRP fabrics and integrating them with the existing structural system. In this context, 1/3 scaled 2-story 1-bay reinforced concrete frames were tested. The frame of the test specimens was detailed to include the common deficiencies of the structures in Turkey. All together seven specimens were tested. The arrangement of the CFRP layers, the amount of CFRP used, the anchorage of CFRP fabric to the wall and the frame elements were the major parameters investigated. This paper summarizes the tests carried out to develop an efficient strengthening method for existing structures by the application of CFRP fabrics to the hollow clay tile infills.

6. J. Bhattacharjee “REPAIR, REHABILITATION & RETROFITTING OF RCC FOR SUSTAINABLE DEVELOPMENT WITH CASE STUDIES” Civil Engineering and Urban Planning: An International Journal (CiVEJ) Vol.3, No.2, June 2016

From this Paper I Refer-

The construction material mainly reinforced concrete is being used extensively for various types of construction projects. However, the deterioration of Reinforced Concrete structures is recognized as a major problem worldwide. Apart from requiring regular maintenance, many structures require extensive Repair, Rehabilitation & Retrofitting. Over a period of time, as these structures become older, we find in them certain degradation or deterioration with resultant distress manifested in the form of cracking, splitting, delaminating, corrosion etc. Such deteriorated structures can be rehabilitated and retrofitted by using various types of admixtures & modern repair materials. The paper brings out the present state of concrete structures & the major areas where improvement is needed during its service life stage for sustainable development & also the method of carrying out Repair, Rehabilitation & Retrofitting. This has been brought in details in the paper along with Case studies, where the Author of the paper was directly involved in planning and execution of the jobs.

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7. S. B. Halbhavi "Energy Auditing: A Walk through Survey of Library Building of Institute to Reduce the Lighting Cost" INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING Vol. 3, Issue 8, August 2015

From this Paper I Refer-

This paper presents simple walk through energy audit for the lighting load of library section of educational institution. Lighting is a major load in case of educational institution particularly in library section. Lighting is an area which provides a major scope for achieving energy efficiency at the design stage by using the modern energy efficient lamps. Innovation and continuous improvements in lighting design has given big energy saving options. Implementation of energy audit can reduce the wastage of energy and gives good practice of energy conservation. In this paper library loads have been surveyed tabulate, energy saving measures is analyzed involves the replacement of low efficient lighting by high efficient lighting. The outcome of evaluation namely annual consumption reduction, greenhouse gas reduction and payback period is presented.

8. S. Sorace and G. Terenzi "Advanced Seismic Retrofit of a Low-Rise R/C Building" IACSIT International Journal of Engineering and Technology, Vol. 5, No. 3, June 2013

From this Paper I Refer-

The paper offers a synthesis of the design study of an advanced seismic retrofit solution of a low-rise reinforced concrete building, consisting in the installation of a dissipative bracing system incorporating pressurized fluid viscous spring-dampers as passive protective devices. This demonstrative application represents the last stage of the research activities carried out by the authors on this protection technology, also within several international Research Projects. The structural characteristics of the case study building make it representative of a large stock of similar edifices designed with earlier Technical Standards editions, in Italy and other European seismic-prone countries. The mechanical parameters, dimensions, layouts and locations selected for the constituting elements of the system, and the performance assessment analyses in original and rehabilitated conditions carried out according to a full non-linear dynamic approach, are presented. The results of the analyses show a remarkable enhancement of the seismic response capacities of the structure, which allows reaching the high performance levels postulated in the retrofit design.

9. A.B. Mahadik and M.H. Jaiswal " International Journal of Civil Engineering Research. ISSN 2278-3652 Volume 5, Number 4 (2014), pp. 411-416"

From this Paper I Refer-

This paper deals to create awareness amongst the civil engineers, residents and owners of building towards the health examination of existing concrete buildings called as Structural Audit. The need of structural audit is for maintenance and repairs of existing structures whose life has exceeded the age of 30 years to avoid any mishaps and save valuable human life. The concrete is widely used as construction material being inexpensive, easy for construction, applications and because of it high strength-cost ratio. More than ever, the construction industry is concerned with improving the social, economic and environmental parameters of sustainability. In India, from 1980 onwards the infrastructure industry witnessed stepping up of public investment and growth in infrastructure industry which results in construction of new multistory concrete apartments which are now in the age of thirty plus years. There are many buildings during this period and earlier have reduced strength in due course of time because of structural deficiency, material deterioration, unexpected over loadings or physical damage. If, further use of such deteriorated structure is continued it may endanger the lives of occupants and surrounding habitation. There is demand of appropriate actions and measures for all such building structures to improve its performance and restore the desired functions of structures which may leads to increase its functional life.

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10. Ms.ShradhaChandrakantDeshmukh “Energy Conservation and Audit” International Journal of Scientific and Research Publications, Volume 3, Issue 8, August 2013 1 ISSN 2250-3153

From this Paper I Refer-

Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, the energy sector assumes a critical importance in view of the ever-increasing energy needs requiring huge investments to meet them. For reducing cost and increasing efficiency, then use energy conservation, management and audit. The objective of Energy Management is to achieve and maintain optimum energy procurement and utilization, throughout the organization as To minimize energy costs / waste without affecting production and quality. To minimize environmental effects. Energy Audit is the key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with its use, and serves to identify all the energy streams in a facility.

11. Swapnil U Biraris “Structural Audit of Old Structures” International Journal of Engineering Trends and Technology (IJETT) – Volume-43 Number-3 -January 2017

From this Paper I Refer-

Structural audit is an overall health and performance check-up of buildings .It is important to the building to check their safety and they have no risk. It is process of analyses of building And this process suggest a appropriate repairs and retrofitting measures required for the buildings to perform better in its service life structural audit is an important tool for knowing the real health status of the old buildings.

12. Dong Hyup Kim “An Information System Audit Model for Project Quality Improvement by the Agile Methodology” International Journal of Information and Education Technology, Vol. 3, No. 3, June 2013

From this Paper I Refer-

Software development has been applied with various automatized tools and techniques to increase the productivity in order to supply the requested products on time with the highest quality to customers. As a result, numerous software development methodologies have been tried continuously during the practical work. As a consequence of this effort, an agile methodology has recently been utilized in many projects in order to promptly deal with changing demands of customers. In the case of South Korea, project-applicable methodologies have been established and applied to different fields, and this tends to expand further. Information system audit evaluated product suitability throughout the whole development process including the previous step and contributed greatly to the quality enhancement. However, there are several differences between recently growing agile project and the previous one, such as management methods, construction phases, and key products. As a result, information system audit should understand the character of agile and review the comprehensive development process. This paper proposes an audit model that is suitable to the agile project by comparative analysis between the current audit model and agile methodology. Agile methodology audit model will be advantageous to the Agile applied project audit. The model should be verified and supplemented by applying to the practice, and various Agile practical items should be applied continuously and studied further.

13. Rogério Cabral “ A Review of Risk Management in Construction: Opportunities for Improvement” Modern Economy, 2014, 5, 367-383 Published Online April 2014 in SciRes. <http://www.scirp.org/journal/mehttp://dx.doi.org/10.4236/me.2014.54036>

From this Paper I Refer-

To expand knowledge of a search on a particular topic or to gather a significant sample of information that allows the researcher to identify and analyze the current state of knowledge on a topic, this paper presents a structured process for the selection of academic papers, evidence of papers’ relevance through bibliometric analysis, and analysis of the papers’ contents to identify gaps in the knowledge related to the theme under consideration and the objectives of the

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researcher. Starting from an interest in identifying and analyzing valuation models and risk management applied to the construction industry and using the Knowledge Development Process-Constructivist (ProKnow-C), this research identified 12,032 articles in thirteen academic databases. In its subsequent steps, the ProKnow-C allowed, in a process of continuous selection, the choice of the 23 articles that presented quantitative or qualitative risk management models developed for the construction industry. The relevance of this set of papers was demonstrated by bibliometric analysis.

14. Sophiya Sunny Pulickal “A Study on Safety Audit Management System in Kuwait” International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391

From this Paper I Refer-

A construction site is one of the most risky, perilous and accident prone working environment. Everyday construction personnel are exposed to a lot of site perils that could result in injury or even fatality. A complete eradication of these construction site dangers are close to impossibility but, it can be reduced to a considerable extent. The safety audit management system is one step to achieve a better, safe and accident-free working environment. A safety audit was prepared on MS Excel and 19 major elements were selected for the study. The audit was implemented in SSH International, Kuwait. For the collection of data for the audit, physical checks/inspections were done. Safety engineers, safety officers and others involved in addressing the safety at the workplace were contacted. Safety records, safety logs, safety registers, minutes of safety meetings, etc. were assessed. The factors that could affect the health and safety of the workers at the site were then ranked based on their criticality. The audit score for the consultancy was 79%. Out of the 19 audits elements, 6 elements were ranked as the primary and secondary causes of accidents. The improper usage of the following 6 elements could affect the Health and the safety of the construction personnel at the aforementioned construction site. The six elements were the following: Amenities/Sanitation, Electrical Works, Excavations, Tools and equipment, Fire protection and hot works, and Personal Protective Equipment's (PPE's). The practical implication of the audit is that the actual work-site conditions could be taken into account through the audit, and based on the happenings at the work-site, suggestive measures could be given.

15. Ebrahim Mohammed Al-Matari “The Effect of the Internal Audit and Firm Performance: A Proposed Research Framework” International Review of Management and Marketing Vol. 4, No. 1, 2014, pp.34-41

From this Paper I Refer-

This study attempts to propose a structure of the relationships between the internal audits characteristics (IAC); such as professional qualifications of the chief audit executive of the Internal Audit (IA), size, experience, and qualification; and firm performance. The presence of an internal audit department is significant as it is considered as the main element in employing accounting systems and this, in turn, assists in evaluating the department's work. The internal audit is deemed as the core of business accounting as it is the section that keeps track of all businesses associated with the sector. The internal audit efficiency assists in developing the company's work because the financial reports present the internal audit department's quality. In addition, an internal audit is a crucial part of corporate governance structure in an organization and corporate governance (CG) covers the activities of oversight conducted by the board of directors and audit committees to ensure credible financial reporting process (Public Oversight Board, 1994). Consistent with previous studies of the importance of internal audit, this study provides comprehensive oversights on the relationship between internal audit and firm performance. The past literature reveals there is a paucity of studies exploring the association between internal audit characteristics (IAC) and firm performance whether conceptual or empirical. The main objective of this study is to fill up the gap in the literature and provide an opportunity for future research to deeply to investigate this relationship.

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16. Yuedong Li “THE INFLUENCE OF CORPORATION GOVERNANCE STRUCTURE ON INTERNAL CONTROL AUDIT REPORT LAG: EVIDENCE FROM CHINA”

From this Paper I Refer-

This paper examines whether corporation governance structure has influence on internal audit report lag (IARL). The study studies a sample of 1244 observations from Year 2008 to Year 2011, obtained from Shenzhen Stock Exchange in China. Regression analysis indicates that firms, with fewer directors but more supervisors and members in audit committees as well as less frequent supervisory board meeting, are more likely to reduce IARL. In contrast, this study also demonstrates factors such as the independence of board of supervisors and board of directors, the meeting frequency of board of directors and duality of CEO, hardly exert influence on the IARL. The contribution of this paper is mainly to empirically analyze the influence of corporation governance structure on IARL to improve the timeliness of internal control information disclosure.

17. Dan A. Simunic “China-Related Research in Auditing: A Review and Directions for Future Research” School of Accountancy, Central University of Finance and Economics, China

From this Paper I Refer-

Academic research concerning independent audits of financial statements, including the economic incentives and relations surrounding audit contracts and audit processes, is relatively new. Prior to the mid-1970's, auditing was viewed as a purely practical activity, governed by technical rules largely set by the profession itself. But of course, auditing is a professional business practiced in the broader economy. As such, auditors are subject to economic incentives and the discipline of markets and regulations in which they operate. Moreover, the incentives facing auditors are unusually complex. An independent audit of financial statements is valuable to both existing and potential shareholders and to creditors who do not contract directly with the auditor. Rather, an auditor usually transacts with the legal entity (the company) and interacts extensively with the entity's management whose assertions in the financial statements are the task of the auditor to verify. In addition, neither the quality of an audit nor the auditor's work effort involving complex judgments concerning the nature, extent, and timing of evidence to be collected are directly observable, even to the company's management. Finally, auditors are subject to a considerable amount of professional and government regulation, and these regulations vary by country. Despite such complexities, auditing is a thriving business world-wide and high quality audits are widely recognized to be critically important to the proper functioning of capital markets. These characteristics and complexities contribute to making auditing an interesting and important research area

18. Jodi L. Short” Monitoring Global Supply Chains in Building Structure” Harvard Business School

From this Paper I Refer-

Firms seeking to avoid reputational spillovers that can arise from dangerous, illegal, and unethical behavior at supply chain factories are increasingly relying on private social auditors to provide strategic information about suppliers' conduct. But little is known about what influences auditors' ability to identify and report problems. Our analysis of nearly 17,000 supplier audits reveals that auditors report fewer violations when individual auditors have audited the factory before, when audit teams are less experienced or less trained, when audit teams are all-male, and when audits are paid for by the audited supplier. This first comprehensive and systematic analysis of supply chain monitoring identifies previously overlooked transaction costs and suggests strategies to develop governance structures to mitigate reputational risks by reducing information asymmetries in supply chains.

19. Ente Hsu “On Market Structure, Audit Quality and Attestation Value”

From this Paper I Refer-

Agency theory is the primary methodology for studying the topics of the audit markets in USA. That theory focuses on the principal-agent relationship of enterprisers and managers. However, dealing with an enterprise, the attitudes of the

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enterprisiers in Asia compared are different from those in the USA. This is because most of the enterprisiers in Asia own a large number of shares, and generally become managers of the own companies. Therefore, the problem of examining audit quality in Asia is different from that described in relevant literature in USA. Due to this distinction among businesses, this paper develops a game model to understand the mutual relationships among audit market structures, audit quality, and attestation values by analyzing the interactions among managers, CPAs, and outside investors. This paper shows that different market structures can affect the relationship between audit quality and attestation values. The proposed game model helps explain the empirical findings regarding the inconsistency of payment-cutting competition in audit markets and the low association between audit payments and audit quality.

III. CONCLUSIONS

From above observation of the building we conclude that:

1. Due to combined effects of carbonation, corrosion & effect of continuous drying and wetting and harsh weather condition building structure is in really bad condition and should be subjected to the repair immediately.
2. Structural building appears to be unsound due to external and internal defects. Structural members shoes cracks due to corrosion of the RCC members.
3. Major cracks observed accelerate the passage of water through the wall resulting in leakage of the water.
4. Looking at the aspect of building maintenance it is recommended to repair the building in planned manner.
5. In RCC framed structure RCC members are the major load taking elements so they cannot be left unattended for long period of time.
6. Original strength of the RCC members can be restored by polymer modified mortar method. Major damage in RCC members are due to seepage of water in the members this need to be prevented by stopping the seepage of water into the members.

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