IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"Study of Quality Assurance and Project Management System in High Rise Multistorey R.C.C. Building"

(A Case Study of Residential Township at Pune)

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Abstract: Quality control in high rise buildings typically encompasses assuring amenability with minimum standards of material, equipment and workmanship in demand of assure the performance of the competency according to the design. For the purpose of assuring amenability, standard methods, numeric methods and random samples are normally used as the beginning for accepting or rejecting the work and groups of materials. Construction of high rise buildings provide the comfort living standard for the people and also help in the planning of the cities. If any failures in duration of construction and its facilities can result in more expensive and uneconomic. Even with minor defects or failures, re-construction may be required to fulfill the construction facility operations impaired. In the nastiest case, failures cause personal grievances. The main purpose of this research paper is to present the Quality Assurance & Quality Control in High Rise Buildings. To facility designs, the specifications of work quality are an important feature. Also for the high rise building the requirements and laboratory tests that are essential for it are mentioned. This chapter also shows the importance of analytical quality assurance during the construction process and presents an introduction to successful and economic method development.

Key words - High Rise Building, Quality Control, Parameters in Quality Assurance, Planning, Construction Techniques.

I. INTRODUCTION

The Quality is an important factor when it comes to any product or service. With the high market competition, quality has become the market differentiator for almost all products and services. Therefore, all manufacturers and service providers out there constantly look for enhancing their product or the service quality.

Quality inspections on site (Site Supervision)

- Attend contractor(s) progress meetings
- Review and check the contractor(s) methods and techniques
- Monitor the contractor(s) QA/QC procedures
- Review and witness all fields tests and inspections Quality Control

The operational techniques and activities that are used to fulfill requirements for quality and various statistical analyses used to verify continued system performance. For the (whole) project execution, the contractor shall maintain a quality system that is based upon international accepted standards. This quality system is described (by the contractor) in a specific "Project Quality Plan", which should include subjects as project organization, procedures to be applied during engineering, procurement, fabrication, construction and commissioning and a summary of quality control plans. The introduction of innovative and more effective project management for construction is not an academic exercise. As reported by the "Construction Industry Cost Effectiveness Project" of the Business. By common consensus and every available measure, the no longer gets its money's worth in construction, the nation's largest industry The creeping erosion of construction efficiency and productivity is bad news for the entire economy. Construction is a particularly seminal industry. The price of every factory, office building, hotel or power plant that is built affects the price that must be charged for the goods or services produced in it or by it. And that effect generally persists for decades. Too much of the industry remains tethered to the past, partly by inertia and partly by historic divisions. However, it is through the understanding of the entire process of project management that these specialists can respond more effectively to the owner's desires for their services.

Improvement of project management not only can aid the construction industry but may also be the engine for the national and world economy. However, if we are to make meaningful improvements, we must first understand the construction industry, its operating environment and the institutional constraints affecting its activities as well as the nature of project management.

Quality management system (QMS) is defined as "all activities of the overall management function that determine the quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance and quality improvement.

1.1 Objectives:

1. Investigate the implementation of QMS in the construction industry.
2. Determine the major factors that are mostly affect the quality of construction during the construction.
3. To create the quality awareness in construction organizations or companies.
4. To minimize the indirect cost of the project and reduce the wastage of wastage of materials, time, money, manpower.
5. Application and comparative study of conventional method with relation to MSP and Primavera.

II. LITERATURE REVIEW

2.1 Rohitkumar.B.R.1, Sachin .P. Dyavappanavar2, Sushmitha.N.J,3Sunitha.V4, Vinayak.Yadwad5 Analysis and design of Multi stored Structure Using ETABS International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 05 | May -2017

Most structures have a simple geometry with horizontal beams and vertical columns. ETABS version 2009 allows for any building layout, however in most circumstances, a simple grid system defined by horizontal floors and vertical column lines may generate building geometry with minimal effort. Buildings have a lot of comparable floor levels. This similarity may be exploited to cut modelling and design time in half. Our major goal is to finish a multi-story building and guarantee that it is safe and inexpensive against gravity loading circumstances, as well as to fulfil the function for which the buildings were designed. The dead load and live load are taken into account while designing the structure. The structure was analyzed and designed using the ETABS software tool. We used the limit state approach of analysis in this multi-story building project. The design has been approved by IS 456-2000.

2.2 Laimdota SNĪDERE, Ineta GEIPELE , Iveta STĀMURE, Riga Technical University, Latvia Corresponding author "CASE STUDY OF STANDARD MULTI-STOREY RESIDENTIAL BUILDING OWNERS AND TENANTS PERCEPTION OF BUILDING TECHNICAL CONDITIONS AND RENOVATION ISSUES" ISSN: 2255-9671 (online) November 2017, 5, 6–22 doi: 10.1515/bjreecm-2017-0002 :

Most Latvians live in multi-story residential complexes built between 1950 and 1992. These structures are now outmoded; also, the durability and dependability standards were projected to be insufficient throughout the construction process. Despite the availability of EU and government support as well as co-financing for building rehabilitation projects, tenants of ordinary multi-story residential structures in Riga do not support and are inactive. The majority of respondents believe that the family's most valuable asset is the residence. Furthermore, 34%–69% of individuals have modified their residence and conserve resources inside their unit borders. Only a few respondents evaluate the technical condition of communal property, but the majority lack information about resource supply and energy accounting, are uninterested in resource-saving opportunities within the building in general, and do not understand the importance of building technical maintenance.

2.3 Mr. Sachin Pashupatihal, Prof. Vidyasagar V. Moogi Planning and Scheduling for a Multi-Storied Building using MS-Project International Research Journal of Engineering and Technology(IRJET)e-ISSN: 2395-0056Volume: 06 Issue: 07| July2019www.irjet.net :

The goal of this project is to investigate the scheduling techniques and construction system of work for multistory buildings, as well as to use Microsoft project software to the planning and scheduling of a multistory RCC building's construction and cost of conformity for the project. A hypothetical RCC residential G+7 building is regarded to complete the objectives. The whole planning and scheduling of this project is analyzed using conventional techniques employed by Architects, Engineers, and contractors, and then contrasted using current computerized techniques. The RCC building is planned and scheduled using Microsoft project software in this method. According to observations, Microsoft project software is a good tool for creating Gantt charts for the schedule of a construction project and gives the shortest period of construction time through schedule crunching and project crashing techniques in software. The current study provides useful information regarding the use of Microsoft project software for building construction planning and scheduling.

2.4 Vikas Pate, Brijesh Singh, P N Ojha , Amit Sagar CASE STUDY ON QUALITY ASSURANCE SYSTEM IN CONSTRUCTION Sustainable Structure and Materials, Vol. 3, No .2, (2021) 012-24 DOI: 2021.04.01.012

In the open economy age, quality has emerged as a critical factor in determining an organization's success or failure. Quality has always been a major concern, despite its hidden nature. Currently under development. Cost, time, and quality are all required to be balanced in construction projects. Because of the prevalence of neglect and a lack of understanding, quality assurance is required, particularly in the food industry. Smaller projects result in worse construction quality. The establishment and implementation of a quality assurance system for the overall improvement of building quality has become a critical concern. In the current article, 30 construction projects from the National Capital Region (NCR) with construction costs ranging from three to five crores were chosen, and data on different quality and management elements was collected from these projects. These 30 projects include structures such as school buildings, community halls, and hostel blocks, among others. The research was carried out for several government agencies' construction projects. This investigation focused on the aspects that play a vital role in the

quality of a structure during construction, such as the client's commitment to quality, material quality, documentation, work methods, staff, and so on. According to the data analysis, the quality assurance system for these projects was classified as Excellent, Good, Average, and Poor in Quality Grading based on the numerous aspects that directly or indirectly impact the quality and smooth operation of the project during and after construction.

2.5 Mr. Sahil Sanjeev Salvi1 , Ms. Samiksha Shridhar Kerkar Quality Assurance and Quality Control for Project Effectiveness in Construction and Management International Journal of Engineering Research & Technology (IJERT) http://www.ijert.org ISSN: 2278-0181 IJERTV9IS020028 (This work is licensed under a Creative Commons Attribution 4.0 International License.) Published by : www.ijert.org Vol. 9 Issue 02, February-2020

The process of developing a Quality Assurance and Quality Control System makes it evident that quality does not happen by coincidence; it must be controlled at every stage of the product's life cycle. A quality system is a method that allows a corporation to organize and manage its resources in order to attain, sustain, and enhance quality on a budget. Financial control systems, information technology systems, and human management systems are all examples of quality systems. A perilous point is reached after all of the time and effort has been used in developing the initial system. The risk is that, once completed, the system will become a neatly packaged inviolate document. This is precisely what must be avoided, and real steps must be done to prevent it. A well-directed quality auditing program should concentrate on making procedures more successful in terms of both Total Quality and the company's goals. QC should be practiced at several stages of the construction process, including pre-construction, construction, and post-construction. The use of materials for structural members manufactured under regulated conditions and under tight monitoring should be encouraged as much as feasible. Finally, keep in mind that our Quality Assurance and Quality Control System is a living organism that requires a two-way flow of information to improve.

2.6 Mr. Pravin P. Mane , Jalindar R. Patil Quality Assurance in Building Construction: A Questionnaire Survey of Occupants Volume-5, Issue-2, April-2015 International Journal of Engineering and Management Research Page Number: 269-273

One of the features of a quality management system is quality assurance (QMS). In the construction sector, the Quality Management System relates to quality planning, quality assurance, and quality control. In the construction sector, quality management systems (QMS) have a wide range of applications and can be applied at both the business and project level. The authors conducted a questionnaire survey with residents of a residential building/flat. The goal of the study is to identify roadblocks to QMS implementation in construction projects. maintaining the needed level of construction work in order to satisfy customers, resulting in long-term competitiveness and business survival for businesses (Tan & Abdul-Rahman, 2005). Customer satisfaction is the first point for quality assurance. Client demands are identified first, and quality control is only completed when the customer is completely pleased. The residents of the building/flat following possession are considered customers in this research. In the construction of the building/flat, it is required to meet their requirements. Customer satisfaction is crucial, according to ISO 9001 principles. The current study was conducted in the Pimpri district of Maharashtra state, India, with the goal of determining customer satisfaction in the construction business. Quality management is defined by ISO 8402, the quality vocabulary, as "all activities of the overall management function that determine the quality policy, objectives, and responsibilities, and implement them within the quality system by means such as quality planning, quality control, quality assurance, and quality improvement." In the meanwhile, ISO 8402 defines a quality system as "the organizational structure, responsibilities, processes, and resources required to achieve quality management."

2.7 Mr. Allan Chung1 and Ivan Mutis, Quality Assurance and Quality Control of High-Rise Enclosure Design Using Lean Principles:

There is a recent trend in the construction industry to implement lean concepts. This management strategy is based on a production philosophy originating from the Toyota Production System (TPS) in the 1950s. After World War II, resources were extremely limited, which made it crucial for assembly processes to be as efficient as possible. This led to a focus on minimizing waste and conserving time and the use of physical products. Preassembly, therefore, became a critical phase of the assembly process. In the construction industry, engineers' primary focus is on incorporating lean strategy for production in shop and field environments; however, opportunities exist to apply the philosophy of the lean concept during the development of design phases. This research proposes that a lean strategy is fully applicable to the design process and the preconstruction phases. According to this study, a lean strategy may be used to the design process as well as the preconstruction phase. A case study incorporating the quality assurance and quality control (QAQC) methodologies of façade design and manufacturing is created to demonstrate the application of lean ideas.

2.8 Mr. Ayman Rashed Alshehri "QUALITY MANAGEMENT SYSTEM FOR BUILDING MAINTENANCE" Heriot-Watt University School of Energy, Geoscience, Infrastructure and Society March, 2016

Quality management (QM) is defined as a set of concepts, principles, or procedures that combine prescriptive viewpoints with empirical data to build and operate an industry.to boost the efficiency Building Maintenance (BM) is increasing as a percentage of total revenue. The production of the construction sector has increased awareness of the necessity to manage.

structures in an efficient manner The cost of construction projects in the Kingdom of Saudi Arabia is on the rise. Riyadh City's 2014 budget is around SR 181 billion, which includes the operation and other costs. In 2014, maintenance projects cost SR 10 billion. However, this segment of the industry faces several challenges in the Kingdom. The nature of BM is examined in detail in the literature review, to ensure the subsequent collection of appropriate knowledge and information from the empirical interviews and focus group discussions. The first qualitative exercise relates to interviews conducted to collect information to examine the current BM processes in public departments, with a view to ascertaining underlying problems and assess awareness and implementation of QMCs.

III. RESEARCH METHODOLOGY

3.1 Problem Statement

In other manufacturing industries are establishing the TQM (Total Quality Management) system but in construction industry we are not able to establish even QMS (Quality Management System). The reason behind this is quality which is ever changing factor i.e. quality changes time to time, place to place. But many common activities in construction project like the concreting work, Brick work, plastering, waterproofing etc. Those common works are affected by some major factors like quality of material, quality of workmanship, construction detailing and drawing, concrete work, etc. Quality Management System is more helpful for creating cost oriented quality awareness in construction companies.

Objectives behind this are as follows

- Determine the major factors that are mostly affect the quality of construction during the construction particularly during execution phase.
- To create the quality awareness in construction organizations or companies.
- To minimize the indirect cost of the project and also reduce the wastage of wastage of materials, time, money, manpower, etc.
- Investigate the implementation of QMS in the construction industry.

3.2 Methodology

The methodology for the work consists of three step model. The first step is quality planning, second step is quality control and third step is quality assurance. In the first step the questionnaires have been prepared by authors considering quality aspects of construction project. The questionnaires have been prepared by authors based on quality aspects in Proceedings of the Civil Engineering PG Conference 2015, Held at MAEER's MIT, Pune-411038, 24-25 April 2015. Advances and Research in Civil Engineering and Technology - Construction Management 324 construction project for builder / contractor, consultants and customers / occupants of buildings. The study describes the rating aspects based on importance on five-point scale for analysis of data collected during interviews with builder / contractor. In second step the interviews of participants of construction project.

The respondents are having position of project manager, project engineer at construction projects with experience not less than fifteen years. The number of questions will be asked to them and the various optional points for some questions are provided. The respondents have to rate these points on five- point rating scale. The scale description is as "5= Very Strong, 4= Strong, 3= Moderate, 2= Less, 1= Very less". In the analysis of data all the options of questions have been studied and the findings have mentioned in the subsequent section of paper.

IV. DATA COLLECTION & ANALYSIS:

The data was collected by reviewing various literatures from research journal, online websites, project records, manual and news from internet The most dramatic new technology applied to construction has been the Internet and its private, corporate Intranet versions. The Internet is widely used as a means to foster collaboration among professionals on a project, to communicate for bids and results, and to procure necessary goods and services. Real time video from specific construction sites is widely used to illustrate construction progress to interested parties. The result has been more effective collaboration, communication and procurement.

A. MICROSOFT PROJECT (MSP) :

Microsoft Project (MSP) is a project management software program developed by Microsoft organization, which is intended to help a project manager in any type of project to improve a plan, to allocate resources, to track the improvement, to accomplish the budget and to examine the amount of work. Budgets in a project are based on the assigned work and the cost of resources. Resources viz., Labour, material, and equipment can be shared among the projects using a mutual resource pond. Every resource has its individual calendar in which days and time are represented for the availability. Resource assigned costs are calculated based on resource rates. MSP application can create critical path schedules, and these can be resource leveled and task networks are pictured in the form of Gantt charts.

B. PRIMAVERA:

Generally Primavera P6 do works on the methodology of dynamic scheduling. Which indeed provides the Project Management office with a clear route map, which is intended to establish.

The best possible optimized plan of the project by using 'what-if' scenarios risk extenuation methods. Despite, the fact that it exhibits the Project Manager's capability to produce management change possibilities for the Project Management team to select from the when variances by the proposed project Baseline are being noticed. The method of dynamic scheduling frames the base or the platforms for the project scheduling which is designed to support the team of Project Management with certain official philosophies, policy, guidelines, terminology, templates and procedures which could include the coaching and training tool or platform through which a particular timeline of events, steps, and the project milestones are accomplished.

Dynamic scheduling methodology is based on the below mentioned some indirect activities which are executed by the various Project Management team and its stakeholders. The effects of many new technologies on construction costs have been mixed because of the high development costs for new technologies. However, it is unmistakable that design professionals and construction contractors who have not adapted to changing technologies have been forced out of the mainstream of design and construction activities. Ultimately, construction quality and cost can be improved with the adoption of new technologies which are proved to be efficient from both the viewpoints of performance and economy.

V. Case study details:

- Name of the project: “GODREJ G-24” residential project Highrise building
- Location: Rajive Gandhi Infotech Park Hinjawdi Phase-1
- Type of the project: Residential apartment
- No of stories: G+19 with basement
- Start of the project: 13 March 2019
- Completion of project: 31 April 2022
- Site Area: 1.4 million Sq. Ft
- Type of construction: RCC Mivan structure.

VI. SITE OBSERVATION:

The following observations are noted in field for the quality control and quality assurance:

6.1 P.C.C: PLAIN CEMENT CONCRETE:

Plain cement concrete (PCC) is used to provide rigid impervious bed to RCC in foundation where the earth is soft and yielding. PCC can be used over brick flat soling or without brick flat soling. Plain cement concrete can also have called only "cement concrete (CC)" or "binding concrete"

- Check the dimensions of form work of PCC before mixing concrete.
- Check polythene sheet is laid over PCC bed.
- Check the concrete slump (maximum slump should be 75mm)
- Check the thickness level of PCC before casting by putting steel pegs in concreting area or putting level pillar of fresh concrete at suitable distance
- Check the finish level of PCC by thread fixing with nails in form work.
- Inspect if the concrete is placing gently

5.2 RCC: REINFORCED CEMENT CONCRETE:

The following observations assurance Footing, Column Starters Columns, Beams, Slabs, Shear walls, Stair Cases are noted in field for the quality control and quality

5.3 FOOTINGS:

Footings are structural elements that transmit column or wall loads to the underlying soil below the structure. Footings are designed to transmit these loads to the soil without exceeding its safe bearing capacity, to prevent excessive settlement of the structure to a tolerable limit, to minimize differential settlement, and to prevent sliding and overturning. Footings are laid above the PCC to support the structure according to the dimensions given in the plan with Reinforcement

Marking of Footings, laying of footings, Checking of Footings

5.4 MARKING OF FOOTING:

According to the grid lines marked on the site the PCC is laid, that grids are transferred to the PPC and by that reference the marking of the footing is done.

5.5 LAYING OF FOOTING:

Laying of footing is done on PPC, it required all the shuttering works and the reinforcement works

CHECKING OF FOOTINGS: Reinforcement checks, Shuttering checks are required to checking of footings.

REINFORCEMENT CHECKS:

1. Steel Placing: The steel has to be placed in a proper way as per the drawings
2. Spacing: After placing the steel the spacing should be checked properly with the reference of the markings and weather there are as per the drawings or not
3. Number of Bars: Check whether the given number of bars is placed or not
4. Diameter of Bars: This is the important factor that will consider mainly while laying of the reinforcement. The diameter of the bars has to be placed in the same direction as given in the drawings
5. Chair height calculations: Mainly chairs are provided to avoid the contact of the top mat to the bottom mat. The height of the chairs is dependent on the depth of footing
6. Alignments: In this reinforcement checks the alignments are checked by considering the covers on the all sides of the footing

SHUTTERING CHECKS:

1. Profile (level): Weather the top of the footing is level or not has to be checked in these checks.
2. Alignments: The footings are to be laid in the same alignments, if not there may be a chances of changing the position
3. Plumb: The vertical of the footing is checked by using the plump
4. Dimensions: The dimensions of footing as to be laid same in the site as per the drawings given. For that, the dimensions
5. Diagonal: After marking the footing dimensions on the PCC it has to be checked diagonally.
6. Supports: After providing the shuttering works it has to support by some supports, so that can avoid the leakage of the concrete
7. When it is poured. For providing this supports the excavations has to be done 1 foot extra excluding the dimension of the footing not in the depth.

8. Gaps: The gaps between the shuttering works has to be avoided, so when the concrete is poured the leakage arrested
9. Covers: After laying of the reinforcement the covers have to be checked. If it is not, there may be chances of increasing the cover at one side and decreasing the cover at other side.

5.6 COLUMN STARTERS:

This work is done immediately after the completion of the footing. It is done just to support the column shuttering. The height of the column starters is in between 3'' to 6" Advantages of Column Starters:

- It will support the shuttering in the proper position
- Leakage of the concrete is controlled by using this starter

5.7 COLUMN:

Column or pillar in architecture and structural engineering is a structural element that transmits, through compression, weight of the structure above to other structural elements below Checks conducted for the columns

- Reinforcement Checks
- Shuttering Checks

REINFORCEMENT CHECKS:

- Steel Placing: The steel has to be placed in a proper way as per the drawings
- Spacing: After placing the steel the spacing should be checked properly with the reference of the markings and weather there are as per the drawings or not. Number of Bars Check whether the given number of bars are placed or not.
- Diameter of Bars: This is the important factor that will consider mainly while laying of the reinforcement. The diameter of the bars has to be placed in the same direction as given in the drawings

5.9 LAPPING:

Steel reinforcement usually comes in 6m (200 ft) and 12m (50ft) lengths. In such cases where the steel reinforcement is requiring to exceed these lengths, or other cut lengths then a splice is required. This lap length as we would discuss REGULAR varies depending on the bars sizes as there are various bar sizes and where the bars are lapped and/or which structural member or element the lapping occurs.

6.0 SHUTTERING CHECKS:

Alignments:

The footings are to be laid in the same alignments; if not there may be chances of changing the position of the footing Plumb: The vertical of the footing is checked by using the plump Dimensions: The dimensions of footing as to be laid same in the site as per drawings given. For that, the dimensions of the footings can be accurately checked Diagonal: After marking the footing supports, dimensions on the PCC it has to be checked diagonally Supports: After providing the shuttering works it has to supported by some so that can avoid the leakage of the concrete when it is poured. For providing this supports the excavations has to be done 1 foot extra excluding the dimension of the footing not in the depth Gaps: The gaps between the shuttering works has to be avoided, so the concrete is poured the leakage can be arrested Covers: After laying of the reinforcement the covers has to be checked. If it is not, there may be chances of increasing the cover at one side and decreasing the cover at other side.

6.1 BEAMS:

A beam is a structural member which spans horizontally between supports and carries loads which act at right angles to the length of the beam. Furthermore, the width and depth of the beam are "small" compared with the span. Typically, the width and depth are less than span/10 Types of beams used in these constructions:

1. Inverted beam
2. Concealed beam
3. T- beams Inverted beam:

The beam whose bottom level is same that of slab called inverted beam, likely to be used only in top slab of the building to give good view for inner face of the building Concealed beam: The Hidden beam is a means to describe the load dispersion on to supporting slab. Hidden beams are generally inserted within the suspended slabs where slab thickness is considerable. The hidden beam is not a beam and the only means to spread the concentrated load of the walls on the slab area. Hidden beam between balcony and room is very common to facilitate easy inclusion of balcony into room space later. It is also known as "Concealed Beam".

6.2 SLAB:

A slab is structural member whose dimensions are small compared to its length. A concrete slab is a common structural element of modern buildings. Horizontal slabs of steel reinforced concrete, typically between 100 and 500 millimeters thick, are most often used to construct floors and ceilings, while thinner slabs are also used for exterior paving.

6.3 Types of Slabs: 1. PT Slabs, 2. RCC slab, 3. Flat Slabs, 4. Grade Slabs

VI. CONCLUSION:

A field study was conducted on construction sites to determine the present site quality management system, and the following were reviewed: There is no quality management in place. enterprises, and there is a lot of room for improvement in terms of adopting quality Management of work in the design stage to reduce flaws A significant quantity of rework is performed during the building process. Many building projects have failed owing to flaws in design and specification. Companies agreed on the benefits of QMS in order to better performance as a result of increased competition among The primary reason for not using construction companies

There is a paucity of quality management implementation on-site. financial assistance and understanding of QMS. Check lists are a high-quality instrument used in building projects. Quality of craftsmanship in all operations is the quality control measure utilized on site. Respondents firmly said that they adhere to a regular timetable for quality control during the planning and design phases of building projects. Poor planning is one of the barriers to project team excellent work. In addition, respondents placed a high value on customer satisfaction. According to respondents, adoption of a quality management plan on site is also vital, and more emphasis should be placed on test results from suppliers rather than physical testing on site.

The survey suggests that customer's satisfaction is always important provided that satisfaction of all other participants of project is also important. It also reveals that importance of total quality management at construction projects. After study of all above points the researcher reached the following concluding remarks as below,

- Satisfaction of all stakeholders in the industry.
- Better understanding on quality control procedure.
- Satisfaction of Client.
- Suitable quality control method for the project.
- Development of the quality of strength in construction.
- Total Quality Management at construction project.

VII.ACKNOWLEDGMENT

We express our sincere thanks to PG coordinator Prof. Abhijit Bhirud for his continuous support. I also thankful to our Head of the department Dr. Navnath V. Khadake, also supporting staff, teaching & Non-teaching Staff.

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