

“Construction Quality Management on Site”

Rizwan Showket¹

¹M. Tech (CTM) Scholar from Desh Bhagat University Punjab

Abstract Rome wasn't built in a day. All that magnificent and painstakingly wrought architecture wouldn't have endured the test of time and wowed generations after generation had it not been for a well mapped out strategy, workmanship and quality. The same holds true even for a construction project. To be able to bring it to fruition, it needs construction project management, has to be meticulously planned and executed from ground up. It needs to progress steadily under the experienced tutelage of people who know their trade and can pull through any challenging situation. The Quality Management System (QMS) in construction industry refers to quality planning, quality assurance, quality control. The main goal of construction industry is to ensure that construction projects are successfully completed within the constraints of best quality, stated period and at minimum possible cost. The research based on QMS recommended that construction companies should create a flexible and conducive organizational atmosphere which encourages the development of quality management system in all aspects of their work. The questionnaire survey has been carried out in the present study by taking interviews of participants of project. This paper describes the analysis of data collected during interviews & questionnaires with Sr. Quality Engineers, Contractors and Clients.

Key Words: Independent Inspections, QA/AC, Quality Edge, Management

1. INTRODUCTION

Quality in construction industry can be defined as the attainment of acceptable levels of performance from construction activities. This performance would be attained when the activity meets or exceeds the requirement of the client or the owner. The quality of any product or service is achieved when it conforms to the desired specifications. Construction projects are always expected to create a balance between cost, time and quality. It is possible to have high quality and low cost, but at the expense of time, and conversely to have high quality and a fast project, but at a cost. High quality is not always the primary objective for the client; however, it is extremely important to a successful project. An appropriate level of quality could be determined during all phases of the construction project. Specially, construction and commissioning are two critical phases where the project could impact by its operability, availability, reliability, and maintainability of a facility. Ultimately, a facility with a good construction quality program and minimal defects is more likely to have a smooth and trouble-free transition into the commissioning and qualification phase of the project.

Achieving quality in construction industry in long run is a tough issue and has been a problem. Inefficient or no practice of quality management procedures will result in great loss of time, money, material, resources. Poor quality in construction projects is a common phenomenon in the world [3]. Further, [4] stated that the satisfaction of quality level in the construction projects has not been achieved and, it is a serious problem. However, most of the countries have been evolved to implement quality standards to ensure construction quality. Therefore, it is necessary to investigate the importance of quality for construction project success. Hence, the purpose of this research is to determine the importance of quality for construction project success. The framework of quality for construction project success is developed accordingly.

1.1 QC/QA:

Quality control and quality assurance are used interchangeably; however, in construction, they're two separate parts of quality system management. Without one or the other, the quality system won't be as effective.

Quality assurance is the planning and systemic activities implemented in a quality system to fill quality requirements. So quality assurance is looking at the quality requirements and making a plan to meet requirements. Quality control is the hands-on part of quality assurance. It is the observation of techniques and activities used to fulfill the requirements and plans set forth by quality assurance. While quality control is often a part of operations, QC isn't an effective quality management system.

1.2 Independent Inspections:

Carry out independent inspections at all stages of building in process or at completion stage

- Benefits - Provides a tool to objectively assess the performance of site teams including the contractor and the project management team. This in turn helps to get the desired output from the site team.

- Snap Audits: This is done using a special mobile app developed in-house. This app is compatible with any android smart phones. These audits can be customized to specific requirements of a client.

The information collected during independent inspection services is based on observations made at work as well as secondary data based on documentation available onsite. The coverage of snap audits include:

- Quality Audits
- Safety audits
- Cost and Material Consumption Audits
- Audit of management system
- Insurance audits for Risk assessment and inherent defect insurance liability.

1.3 Quality Edge:

Quality Edge is a quarterly magazine dedicated to quality, safety and environmental aspects of the Architecture, Engineering and Construction (AEC) industry. It is a knowledge portal with the objective of improving the knowledge base of Architectural and Civil Engineering Community on the latest developments,

The highlight of Quality Edge is that we that explore a different subject in detail every time, presenting its varied facets, new thoughts, innovative projects and events.

2.0 Literature Review

A recently published study (Bou-Llusar et al., 2009) reviews the variety of definitions of TQM available in the literature (Oakland, 2000; Dale, 2003; Eriksson and Garvare, 2005) and concludes that it is a management approach which prescribes guidelines for organizations to operate and achieve high performance. Mathews, Ueno, Kekale, Repka, Pereira and Silva (2001) divided quality tools and techniques that are in support of quality programs into three main types, i.e., hard quality tools, mixing methods and soft methods. Hard quality tools are formal quality systems, documented quality systems, quality costs, control charts, and statistical sampling standards. Mixing methods are strategy and action plans review, flexibility of organization structure, control charts, quality circles, and quality planning tools. Soft methods are training, customer satisfaction surveys, regular contact with vendors and external organizations, actions to optimize environment impact, empowerment, self-assessment, and benchmarking. Taylor et al. (2003) concluded that senior managers' involvement, understanding and customer focus are essential antecedents of TQM success. Samson et al. (1999) described that leadership and human resources management are among strong predictors of performance TQM practices. On construction related research, Low et al. (2004) commented that top management commitment as one of the elements that would reflect TQM performance measures in construction firms. Chin et al. (2003) found that top management commitment is the most critical factor for the successful implementation of ISO 9000. ISO 9000 deals with the fundamentals of quality management systems (Quality Standard, 2008; Tsim et al, 2002), including the eight management principles (Quality Standard, 2008; Beattie and Sohal, 1999; Tsim et al, 2002) on which the family of standards is based. ISO 9001 deals with the requirements that organization wishing to meet the standard they have to fulfill. In order to integrate the quality management system within the context of construction management, the need to study the elements in standard guidelines of quality management system is essential to ensure the standardization of the quality management system is successful.

According to Lydia (2010), the guidelines to ensure the quality in planning are:

- Ensure that all relevant parties involved including consultants, subcontractors and suppliers are included in the task of quality planning for the project
- Establish and define the purpose of the quality system.
- In the plan, minimize the effort required to amend copies of documents
- Set up a quality system development team so that the team can produce an effective plan
- Ensure that throughout the quality planning task constantly focused on the customer requirements.

3. RESEARCH METHODOLOGY

The methodology for the work consists of two step model. The first step is questioning by mail to highly experienced quality engineers and second step is Quality control and quality assurance on site. In the first step the questions will be asked to senior Quality Engineers/Sr. Project Managers of different companies regarding implementation of Quality Management on site and we will know their personal review and finally we will collect all data by mail and make a final list.

Second step is we will make appointment with Sr. Project managers / Sr. Quality Engineers with experience not less than fifteen years and ask them some selected question on quality management. The number of questions will be asked to them and the various optional points for some questions are provided. The respondents has 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.

3.1 DATA COLLECTION & ANALYSIS through Mail:

Table 1: Details of Some senior Quality Engineers/Sr. Project Managers

S. No	Name	Designation	Mail Address	Experience	Company name	Mail received
1	Devender Kumar Singh	Sr. Project Manager	Devendra.jmc@gmail.com	27 years	JMC Projects Limited India	4-July2019
2	Sourabh Kishor Pinku	Sr. Quality Engineer	sourabhkishorpinku@gmail.com	15 years	Mahagun India Pvt Ltd	4-July2019
3	Ved Prakash Soni	Deputy Project Manager	Ved2soni@gmail.com	18 years	JMC Projects Limited India	4-July2019
4	Satay Prakash Chaudhary	Project Manager	spchoudhary02@gmail.com	28 years	JMC Projects Limited India	8-July2019
5	Mosin Khan	Quality Engineer	Mosin.k@cqra.com	7 years	CQRA Pvt Ltd	5-July2019

Table 2: Some Questions & Answers received from senior Quality Engineers/Sr. Project Managers through mail.

S no	Name	Question Answers (1)	Question Answers (2)	Question Answers (3)
		How To implement Quality on site?	Obstacles in the implementations of Quality Management on site?	Personal Reviews?
1	Devender Kumar Singh	1) Enough Resources 2) Team Work 3) Skilled labors	1). Rigid Attitude of high management. 2) Lack of Education and training. 3) Lack of resources	1) team work 2) good material 3) Skilled manpower. 4) Work according to drawing 5) technical staff
2	Sourabh Kishore Pinku	1) Better internal communication 2) Consistent products. 3) Improve Documentation availability.	1) Emphasis on short term objects. 2) too much documents commitment 3) Lack of employees understanding	1) Focus on Quality Standards. 2) Work According to Drawing. 3) Training to technical and non-technical staff.
3	Ved Prakash Soni	1) Skilled Manpower 2) Sufficient Resources. 3) Awareness of work	1) Improper Knowledge 2) Lack of implementation of Indian standards. 3) Time Bond Project	1) awareness of quality 2) skilled person 3) Documentation of work. 4) Supervision
4	Satay Prakash Chaudhary	1) Set a Multi discipline team for each problem 2) Skilled Manpower 3) new techniques	1) Lack of understanding 2) minimum resources 3) Time period	1) Separate team for quality engineers. 2) Work awareness. 3) Awareness of scope.
5	Mosin Khan	1) Skilled Mason	1). Poor quality of material	1) IS should be implemented

		2) Good Communication 3) Newtech equipment's	2) lack of employees commitment 3) Lack of expertise/resources	2) Well Qualified Engineers 3) Skilled Manpower
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3.2 Mail Received from senior Quality Engineers/Sr. Project Managers:

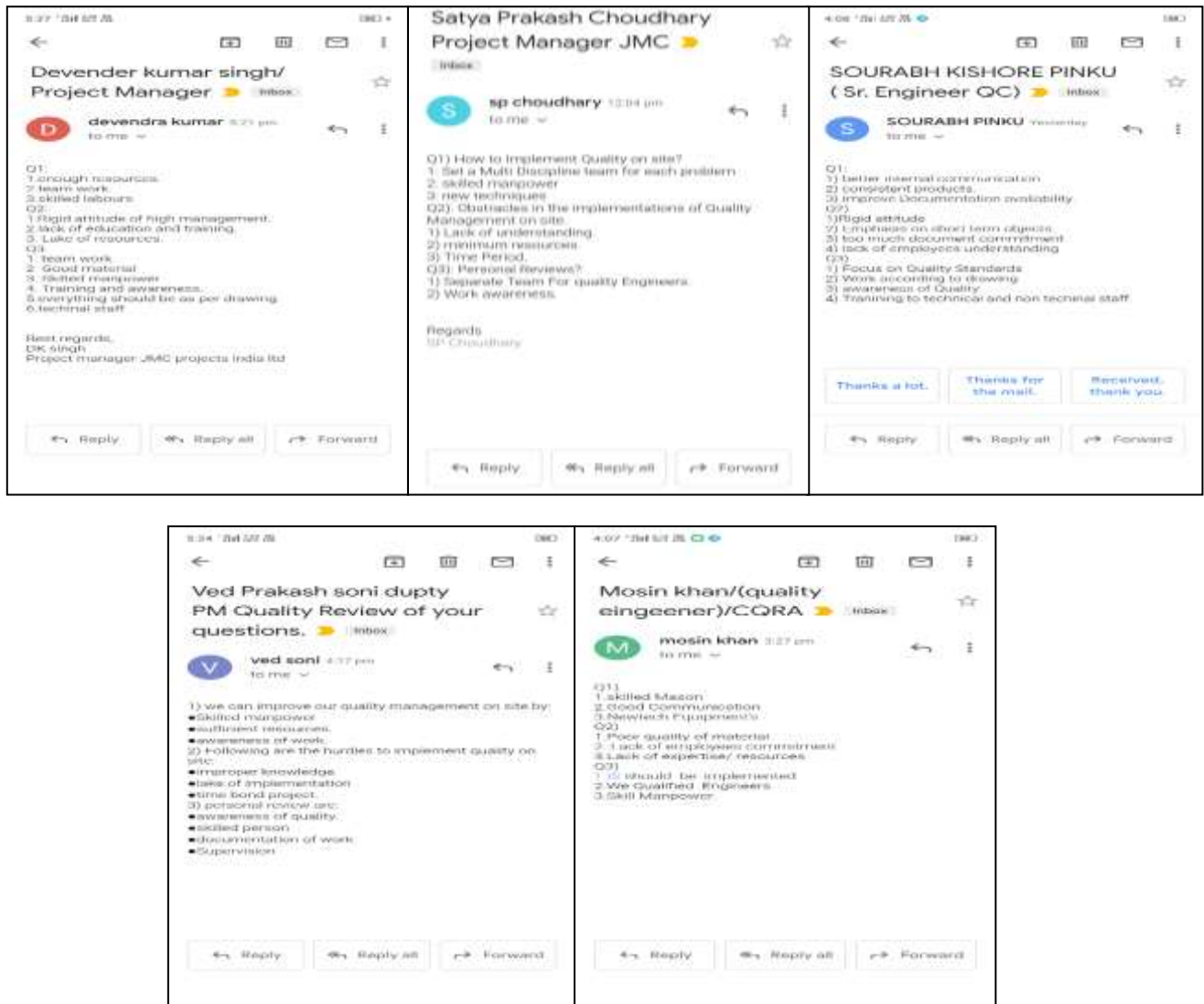


Fig -1: some screenshots of mail received from senior Quality Engineers/Sr. Project Managers:

3.3 DATA COLLECTION & ANALYSIS through Interview:

Table 3: Some Questions & Answers asked during interview to senior Quality Engineers/Sr. Project Managers.

S. No	Questions	Answers	Weighted Average
(A)	QUALITY CONTROL ON SITE		
	Which of these words best define Quality?	60% says Teamwork 30% says Value of money 5% says Satisfying customer 3% says High Cost	"3" Teamwork
1	Proper sampling and testing on site?	100 % says yes	"5"
2	Quality Control laboratory at site	85% says yes	"4.25"

3	Site review meetings with staff	70% says yes				"3.5"
4	Awareness of Responsibilities	65% says yes				"3.25"
(B)	QUALITY MANAGEMENT DURING PLANNING					
1	Coordination with all the activities	81% says yes				"4.1"
2	Notice Daily schedule	87% says yes				"4.35"
3	Follow-Up meeting	90% says yes				"4.5"
(C)	OBSTACLES WORKING IN TEAM WITH RESPECT QUALITY					
1	Rigid attitude of higher management	71% says yes				"3.55"
2	Emphasis on short term objects	69% says yes				"3.45"
3	Lack of Education and training	80% says yes				"4.0"
4	Lack of resources	85% says yes				"4.25"
(D)	TRAINING					
1	Percentage of managerial/supervisory staff undergone through training	90% says yes				"4.5"
2	Percentage of non-manual/Technical staff undergone through training	65% says yes				"3.25"
(E)	OTHER					
1	Order of Importance	Safety-1	Cost-2	Quality-3	Time-4	
2	Percentage of employees who are aware of the importance of Quality?	70% says yes				"3.5"

The above analysis includes calculation of percentage wise weightage:

E.g. if the answer is 90%=90/100= 0.90/2= 4.5 out of 5

There are several methods for analysis of data but for this work I have used simple mathematics i.e. Arithmetic mean = some of observation /no of observations.

4.0 DISCUSSIONS & FINDINGS

As stated first I have made two type of question set, with 25 short questions asked during interview and three important questions given to them (hardcopy) for mail, after a while I received reply from their side through mail attached above.

Question asked to them during interview contains set of series like initially I asked them about the quality control measure used on construction site is the quality of workmanship in all construction activities followed by proper sampling and testing on site, Quality Control laboratory at site, Site review meetings with staff, Awareness of Responsibilities etc. then I asked them about Quality management during planning followed by Coordination with all the activities, Notice Daily schedule, Follow-Up meeting etc we discussed Obstacles working in team with respect Quality followed by Rigid attitude of higher management, Emphasis on short term objects, Lack of Education and training, Lack of resources then finally I asked them about Training followed by Percentage of managerial/supervisory staff undergone through training, Percentage of non-manual/Technical staff undergone through training, other Questions asked to them are Percentage of employees who are aware of the importance of Quality etc. I got different answers from different Project managers/Sr. Quality Engineers with little variation then I segregate all the answers with respect to Percentage and made a scale description as "5= Very Strong, 4= Strong, 3= Moderate, 2= Less, 1= Very less".

Table 4: Arithmetic mean of all observations.

s no	Description	observation 1	observation 2	observation 3	observation 4	Mean	Average weightage
1	QUALITY CONTROL ON SITE	5	4.25	3.5	3.25	4	very strong
2	QUALITY MANAGEMENT DURING PLANNING	4.1	4.35	4.5		4.316	very strong
3	OBSTACLES WORKING IN TEAM WITH RESPECT QUALITY	3.55	3.45	4	4.25	3.812	Strong
4	TRAINING	4.5	3.25			3.875	Strong

5.0 CONCLUSIONS

Very strongly respondent's responses as observe regular schedule for the quality control measure used at site is quality of workmanship in all activities. Very strongly respondent's responses as observe regular schedule for Quality management during planning. Obstacles working in team with respect Quality is Strong. Also, respondents have very strongly given to Training.

After study of all above points through mail and interview i reached the following concluding remarks as below:

- Better internal communication and team work on Quality Control.
- Proper sampling and testing and Quality Control laboratory at site.
- Awareness of Responsibilities and duties on site.
- Suitable quality control method for the project.
- Training to technical and non-technical staff with Focus on Quality Standards.
- Set a Team for Quality Engineers on site.

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BIOGRAPHIES

Rizwan Showket
M. Tech (CTM) Scholar from Desh
Bhagat University Punjab.
BLOG<http://rizwanshowket.blogspot.com/>