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Application of Total Quality Management Principles in Material's Suppliers Evaluation

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Abstract: ***With the globalization of economy, firms are actively engaged to achieve accepted quality levels to ensure their position in emerging market. Unfortunately the construction industry has lagged behind other industries in implementing total quality management which provide excellence in customer satisfaction through continuous improvements of products, processes or services. The reason behind that has been the perception that TQM is for manufacturing and other service sectors only. Now withstanding this challenge, many construction organizations have resorted to the application of Total quality management, with a view to assessing the level of quality and to improve it. This study aims to identify the level of effectiveness of implementation of Total Quality Management Principles by the material's suppliers in Kalashree Construction Company. Initially a qualitative research approach is adopted in this study, where the questionnaire is distributed to suppliers to identify the level of quality practices in organizations and ascertain that they follow the rules of total quality management or not. For further analysis purpose, laboratory tests on materials are conducted based on which the supplier is evaluated.***

Keywords: Construction process, Effectiveness, Suppliers evaluation, Total Quality Management principles.

I. INTRODUCTION

Construction is a one-of-a kind process; its products are highly complex, its supply chain is fragmented, its process is different. During the last decades construction industry has been heavily criticized for its performance and productivity than the other industries. Construction costs are becoming too high and construction project management is more difficult than it should be. At the end of project, project becomes gut-wrenching experience with unnecessary disputes that arise due to insufficient quality and Also construction industry in many parts of the world suffers from the problems such as time overrun, cost overrun, workmanship defects, poor health and safety, low productivity and inadequate quality. A substantial amount of time, money and resources (material and human) are wasted each year in the construction industry due to inefficient quality management procedures.

To be competitive in today's market, it is essential for construction companies to provide more consistent quality and value to owners and customers. Now is the time to leave behind the old adversarial approach of managing construction work. It is the time to initiate more teamwork and to produce better quality work and to develop better relationships with customers. Such goals demand the continuous improvement process for improving quality. This is possible through the TQM approach. Providing customer satisfaction is a main objective of quality management and contractors who are suppliers of construction services must address customer's requirements. Suppliers have a large and direct impact on the cost, quality, and time aspects of the project.

II. OBJECTIVE OF STUDY

The prime objective of this study is to evaluate the process and the performance aspects of the materials manufactured by the suppliers based on the application of Total Quality Management principles and tools such as continuous improvement, benchmarking and six sigma.

III. TOTAL QUALITY MANAGEMENT AND SUPPLIERS EVALUATION METHODS

Total Quality Management:

A simple definition of TQM is a meeting of internal and external customer requirements, and the main difference between quality and TQM is that the quality usually focuses on a temporary process while TQM is a long term process and adopts strategic dimension.

ISO 9001 Facilitating TQM:

1) Customer focus: Meeting customers' requirements is the primary objective of TQM and therefore organization should understand current and future customer needs.
2) Leadership: Leaders establish unity of purpose and direction of organization. Leaders create and maintain internal environment in which people can become fully involved in achieving the organizational objectives.
3) Involvement of people: Peoples at all levels are the essence of organization and their full involvement enables their abilities to be used for the organization benefit.
4) Process approach: A desired result is achieved more efficiently when activities and related resources are managed as a process.
5) System approach to management: Identifying, understanding and managing interrelated processes as a system contributes to the organizations effectiveness and efficiency in achieving its objectives.
6) Continual improvement: Continual improvement of the organizations overall performance should be a permanent objective of the organization.
7) Factual approach to decision making: Effective decisions are based on analysis of data and information.
8) Mutually beneficial supplier relationship: An organization and its suppliers are independent and a mutually beneficial relationship enhances the ability of both to create value.

Suppliers Evaluation:

Supplier selection represents one of the most important decisions in a company to remain competitive, especially now a day, where markets are changing very fast. The supplier selection is a multi-criterion problem which includes both qualitative and quantitative factors (criteria). The most significant criteria are quality of product, the on time delivery, the performance history of the supplier and the warranty policy used by the suppliers.

Four important steps in the supplier selection process are:

1. Evaluating needs and defining objectives.
2. Gathering a limited pool of suppliers.
3. Interviewing with suppliers.
4. Selecting and applying methods.

Suppliers Evaluation Methods:

1. Decision Support Model: This is a multi-criteria decision model for suppliers selection as well as an efficient evaluation procedure for the selected suppliers. The model is based on Simple Multi-attribute Rating Technique Exploiting Ranking method (SMARTER). The main contribution of model is to structure the process of supplier selection, establishing strategic policies on which the company management system relied to make the suppliers selection.

2. Analytical Hierarchic Proces (AHP): AHP is a decision making process for prioritizing alternatives when multiples criteria and sub criteria must be used. It is developed by Saaty in 1980. This process allows decision maker to structure complex problems in the form of hierarchy. Generally hierarchy consist of three levels: the goal, the criteria and the alternatives. For suppliers selection problem, the goal is to select the best supplier from all suppliers. It considers multiple criteria, it may be qualitative or quantitative, and allows them to integrate into a single overall score. The alternatives are the different proposals supplied by the suppliers.

IV. RESEARCH METHODOLOGY

Research methodology is designed so as to meet the prime objective of the study. For data collection Rivera site is taken as a case study. A documented questionnaire survey is conducted in which questionnaire is distributed to the suppliers of the project. Also discussion is made with the supplier to find out the details and material samples such as fly-ash bricks, clay bricks, fine aggregates, coarse aggregates and paving blocks are collected from the suppliers plant and laboratory tests for bricks such as water absorption, compressive strength ,dimension analysis, efflorescence of bricks and density of bricks , for fine aggregates specific gravity, water absorption, bulk density, moisture content , material finer than 75 microns and sieve analysis , for coarse aggregates flakiness index, elongation index, crushing value , impact value, sieve analysis, water absorption and specific gravity and for paving blocks water absorption, compressive strength and flexural strength are conducted in three independent laboratories such as Durocrete, Construction diagnostic center and MIT college lab . The existing manufacturing process of materials such as fly-ash bricks, clay bricks, stones and paving block is examined at the supplier's plant.

V. RESULTS AND DISCUSSION

A questionnaire survey is conducted in which questionnaire is distributed to the suppliers, and there responses for each parameter of quality is given below:

TABLE I: Table showing the response of suppliers for the questionnaire which were distributed to the suppliers

Sr.no	Parameters	Yes	No	N/A
1.	There is a Quality assurance system that is properly implemented and documented.	38	-	-
2.	There is a Quality Assurance Manual.	9	19	10
3.	There are documented procedure and detailed work instructions for all operations which affect quality.	21	9	8
4.	There is a corrective action programme that is implemented.	38	-	-
5.	The Quality Assurance organization trains and documents employees in the application of quality assurance methods.	20	-	18
6.	There is a calibration programme for your test and measurement programme	21	3	14
7.	All of your tests are within calibration	23	-	15
8.	All the raw materials , parts and supplies are rated upon receipt to assure conformance to all requirements	35	-	3
9.	There is a system for rating suppliers for quality and delivery.	31	5	2
10.	Your measurement standards are certified and traceable to Indian standards	25	6	7
11.	Your measuring and test equipment is identified to indicate the last calibration date, by whom and next calibration due date.	21	14	3
12.	You have documented inspection systems for incoming , in-process and final inspection	34	1	3
13.	You have documented shelf life program	2	25	11

14.	Inspection records and traceability are provided with each order	37	1	-
15.	Inspection records are kept minimum for 7 years.	-	34	4
16.	All of the discrepant materials are promptly and adequately identified and separated from normal work operations.	38	-	-

Tests are conducted on materials and their results are shown below:

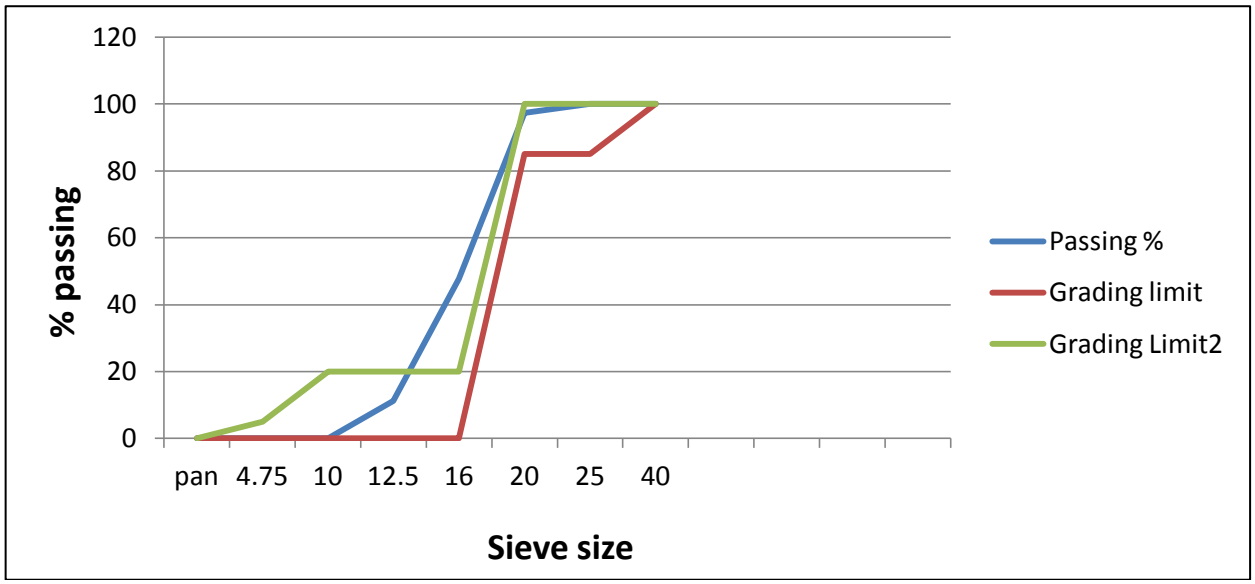


FIG.I: Grading curve for 20 mm aggregates

The available aggregates grading curve does not fall within the standard gradation.

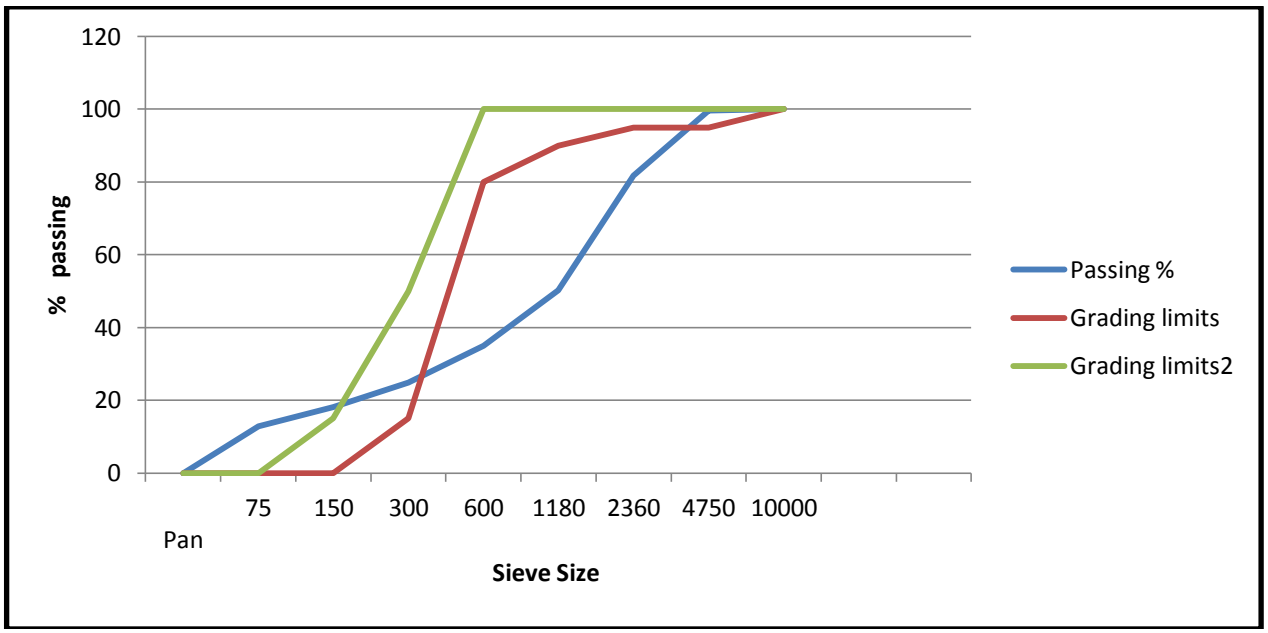


FIG.II Grading curve for 10 mm aggregates

Available Sand does not fall within any of the zones such as zone1, 2, 3 and zone 4.

TABLE II Statistical analysis of tests results of material (fly-ash bricks length)

SR.NO	X	x	(X-x)	(X-x)^2
1	225.8	225.6	0.2	0.04
2	225.3	225.6	-0.3	0.09
3	225.4	225.6	-0.2	0.04
4	225.7	225.6	0.1	0.01
5	225.9	225.6	0.3	0.09
6	225	225.6	-0.6	0.36
7	225	225.6	-0.6	0.36
8	225	225.6	-0.6	0.36
9	225	225.6	-0.6	0.36

10	225	225.6	-0.6	0.36
11	225	225.6	-0.6	0.36
12	225	225.6	-0.6	0.36
13	226	225.6	0.4	0.16
14	226	225.6	0.4	0.16
15	226	225.6	0.4	0.16
16	228	225.6	2.4	5.76
17	226	225.6	0.4	0.16
18	226	225.6	0.4	0.16
19	225	225.6	-0.6	0.36
20	226	225.6	0.4	0.16
			TOTAL	9.87

Range (R) = Largest value-smallest value = 3 mm

Standard deviation (σ) = $\sqrt{\frac{\epsilon(X-x)^2}{n}}$ = 0.70 mm, Comparing this with the expected length of 225mm, **% σ =** $\frac{0.70}{225}$ X 100 = 0.35 which is very less.

Coefficient of variance (C.V) = σ/χ = 0.00311 = 0.31%

Variance (V) = σ^2 = 0.49

Consider data set based on the benchmarked expected variation: x $\mp$ 1 σ

i.e 225.6 $\mp$ 0.70 = 224.9 to 226.3 say 225 to 226.3

Total no of observations in this range is $\frac{19}{20}$ X 100 = 95% (Expected is at 70% observations)

Inference: 1) fly-ash brick length is within the expected benchmarked variation.

2) Considering Zero defects as the ultimate goal, then % defective length = 5%

The brick length is at the 3 sigma level or performance.

Manufacturing process of materials:

1. **Fly-ash bricks:**

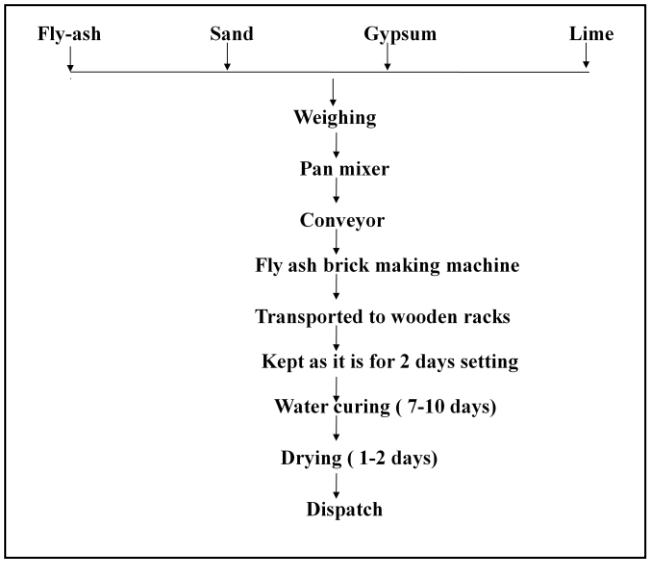


FIG.III Manufacturing process of fly-ash bricks

Positive aspects of the supplier's plant:

1) The machine for the fly-ash is of the high quality and 90% mechanized and its production is 3 times more than conventional mould machine.

2) Less manpower is required.

3)

Negative aspects of the supplier's plant:

1) Skilled labour is required for operating, but they do not have a significant skill.

2) Economical for bulk production

2. Clay bricks:

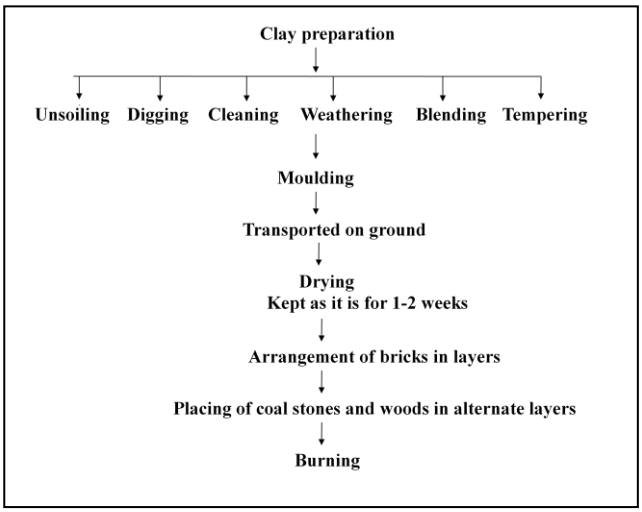


FIG.IV Manufacturing process of Clay bricks

Positive aspects of the supplier's plant:

1) The manufacturing plant is located where the raw material is easily accessible.

2) All the important factors for running the plant, such as labour required, land required for storage, road access, fuel for burning (coal) are easily available from surrounding village.

Negative aspects of the supplier's plant:

1) There is a lack of supervision during manufacturing process, is a major cause which affects quality.

2) The production rate is low due to non-availability of proper tools to the labour.

3. Stones:

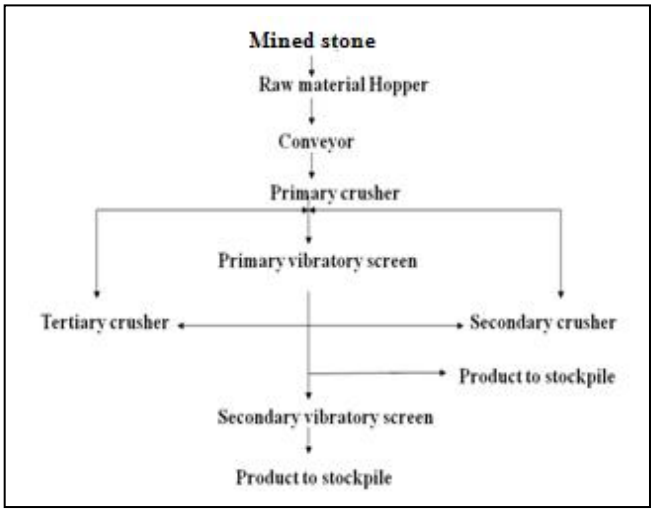


FIG.V Manufacturing process of Stones

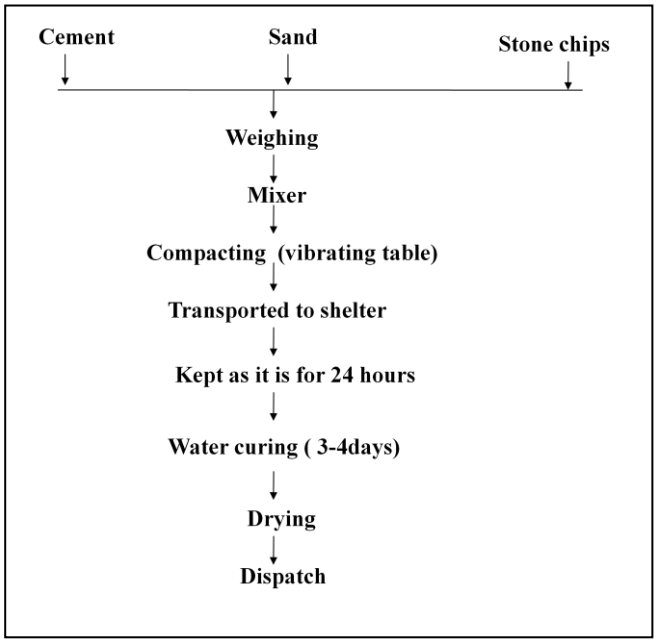
Positive aspects of the supplier's plant:

1) The source is very close and accessible and it has easy access from the main road or nearby village.
2) Good quality of basalt rock is available on site.

Negative aspects of the supplier's plant:

1) The jaw crusher is not properly maintained.
2) Filter media was not provided to prevent dust in the atmosphere.

4. Paving blocks:



Positive aspects of the supplier's plant:

1) Skilled labour, latest equipment and machineries are available at the plant.
2) There is a proper technical supervision during manufacturing process which ensures good quality.

Negative aspects of the supplier's plant

1) Plant has to face shutdowns frequently as ample water and electricity is not available.

VI. Conclusion

1. This study has evaluated the process and performance aspects of the materials manufactured by suppliers based on TQM principles such as Benchmarking and six-sigma.
2. Inferences from the questionnaire survey indicate that the material's suppliers need to focus more on the quality aspects.
3. Inferences from the laboratory tests results indicate that the material's suppliers need to focus more on the manufacturing process of materials as the performance of material is very low, as the Performance level is at 1, 2 and 3 sigma level and is not within expected benchmark.
4. Process study conducted of fly-ash bricks, stones, red bricks and paving blocks indicate that improvement is needed in aspects such as speed of workers, skill of workers, technical supervision, availability of proper tools and machineries and availability of ample water and electricity.

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References

1. Abu Hassan Bin Abu Bakar, Khalid Bin Ali and Eziaku Onyeizu (2011) "Total Quality Management Practices in Large Construction Companies: A Case of Oman" World Applied Sciences Journal 15 (2): 2011 ISSN 1818-4952 © IDOSI Publications, 2011, 285-296.
2. Agha A.S (2011)"Total Quality Management In Construction Industry", ISSN 1537-1506,Vol-10,pages 542-552
3. Bhimaraya A. Metri* (2005) "TQM critical success factors for construction firms" Preliminary communication UDC: 658.56:624,vol-10, pp.61-72.
4. Fernando Schramm, Danielle Costa Morais (2012) Decision support model for selecting and evaluating suppliers in the construction industry Pesquisa Operacional (2012) 32(3): 643-662. 2012 Brazilian Operations Research Society ISSN 0101-7438 / Online version ISSN 1678-5142,32(3), 643-662.
5. Chengter Ho, Phuong-Mai Nguyen (2007) Supplier Evaluation and Selection Criteria in the Construction Industry of Taiwan and Vietnam Information and Management Sciences Volume 18, Number 4, pp. 403-426, 2007
6. Imbeah K.F.(2012)"Framework for implementation of total quality management in real estate firms in Ghana".vol-10,542-552
7. Kee-hung Lai (2010)" Initiatives and outcomes of quality management implementation across industries " Department of Shipping and Transport Logistics The Hong Kong Polytechnic University Hung Hom, Kowloon, Hong Kong, vol-31,Issue 2, pages 41-154.

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