ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

QUALITY CONTROL IN CONSTRUCTION

By
S.Vishnu Vardhan
Construction Engineering And Management
M.S.E.C

ABSTRACT

The purpose of this thesis is to evaluate the use of Quality Function Deployment (QFD) as a management tool to benefit project managers. Quality Control is fundamental to the works and services undertaken by the United Nations Office for Project Services (UNOPS) and shall be practiced by all personnel of the Organization in their daily activities. The project manager has primary responsibility within the construction, to ensure the design both fulfils user's requirements and is prepared correctly, and that quality control/assurance procedures are correctly administered. Quality is enhanced by working systematically, according to formalized procedures, designed to prevent or eliminate errors from occurring. QFD was developed and to improve quality and lower costs in industrial and business related fields, by assuring all of building construction operational decisions are driven by owner needs. It uses a set of matrices to relate owner wants and needs with project specifications and requirements.QFD assists project managers to clearly identify and prioritize owner and labour requirements in development of the conceptual and final design. It is best suited to projects involving repetition of units or when higher-than-average quality is demanded. Managers are able to make better informed decisions made during the delivery process, resulting in a better owner satisfaction. To testing of required building construction materials and to determine the quality and quantity of our required area of the building construction The CQAP details the systems and controls that GE has put in place so that the quality of the project will meet the requirements specified in the report. GE provides definition and overall management of the quality approach to be followed by its contractors and consultants. The quality of the RA implementation will be ensured through an integrated system of quality assurance performed by the Construction Manager and quality control provided by the contractors. GE's Construction. It shall be the responsibility of Project Managers to ensure that these procedures are implemented consistently and effectively, and that they are reviewed regularly to reflect the requirements of the Contracts throughout the duration of works. It shall be the responsibility of the Quality Control Manager to constantly monitor the implementation of the Quality Control Plan to establish and put into practice necessary systems and procedures, and ensure adherence to the Quality Control Plan through regular auditing.

1. INTRODUCTION

1.1 GENERAL

The Construction industry of India is an important indicator of the development as it creates Investment opportunities across various related sectors. The construction industry has contributed an

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

estimated 6708 billion to the national GDP in 2011-12 (a share of around 8%). The industry is fragmented, with a handful of major companies involved in the construction activities across all segments; medium sized companies specializing in niche activities; and small and medium contractors who work on the subcontractor basis and carry out the work in the field. In 2011, there were slightly over 500 construction equipment manufacturing companies in all of India. The sector is labor-intensive and, including indirect jobs, provides employment to more than 35 million people.

The objectives of this Quality Control Plan are to:

• Describe a quality program to be implemented so that the project is constructed in accordance with the contract requirements and industry standards;

• Describe guidelines for inspection and documentation of construction activities;

• Provide reasonable assurance that the completed work will meet or exceed the requirements of the construction drawings and specifications; and

• Describe how any unexpected changes or conditions that could affect the construction quality will be detected, documented, and addressed during construction.

1.2 QUALITY CONTROL

The role of the Quality Control Manager is to assure that the quality requirements of the PTF have been satisfied. The Quality Control Plan requires that the implement the program and use its provisions daily to control quality of the work. Effective Quality Control requires a serious and concentrated effort on the part of the supervisory and inspection personnel. The tools for the accomplishment of effective Quality Control are as follows:

a. Quality Control personnel are described as to education, experience, and capability.
b. Before start of construction, the Quality Control Manager shall conduct a Start-up Meeting with the contractor and discuss the contractor's quality control system. The Start-up Meeting and submittal/acceptance of at least the interim Contractor Quality Control Plan should take place within 10 days of Award. The Contractor Quality Control Plan will be viewed with a critical eye.
c. The Quality Control Manager will assure that the Contractor Quality Control Plan is sufficient to obtain the quality of construction designed in the contract plans and specifications.
d. Quality assurance monitors and confirms quality, but quality control must provide it.

The facility is constructed in accordance with those documents.

1.2.1. INPUTS

Work results, quality management plan, Operational definitions, checklists

1.2.2- TOOLS AND TECH.

Inspection, Control charts, Pareto diagrams, Statistical sampling, flowcharting,Trend analysis

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

1.2.3- OUTPUTS

Quality improvement, Acceptance decisions,rework, Completed checklistProcess adjustment

1.3 QUALITY CONTROL PLAN PHASING:

• Preparatory Phase Meetings: Quality Control meetings will be held before each definable feature of work to ensure that the documentation is complete, materials are on hand, and the people who are to perform the work understand what they need to know about the feature of work. Both the actual contract specifications and those referenced in the contract specifications shall be in the Contractor's library and available to the Quality Control inspector(s). If the Quality Control inspector(s) does not have the required specifications, they cannot know or enforce these provisions.

• Initial Inspections: Quality Control inspections shall be conducted in a timely manner—at the beginning of a definable feature of work. A check of the preliminary work will determine whether or not the Contractor, through his Contractor Quality Control organization and the craftsmen involved, thoroughly understands and is capable of accomplishing the work as specified.

• Follow-up Inspections: Follow-up inspections, also conducted by UNOPS and Contractor's quality control staff, occur daily when work is in progress and are for the purpose of assuring that the controls established in the earlier phases of inspection continue to provide work which conforms to the contract requirements. Most of the comments in both the Contractor Quality Control and Quality Control daily reports result from these inspections.

1.4 PLANS AND SPECIFICATIONS

1.4.1. UNOPS Quality Control Manager will monitor the preparation of design documentation, including plans and specifications, and will:
a) Watch for omissions;
b) Watch for discrepancies between plans and specifications;
c) Check plans and specifications against requirements of which problems occurred on similar jobs; d) Compare elevations, grades and details shown on plans as existing, with those at the actual site; and
e) Report all errors, omissions, discrepancies, and deficiencies to the Design Office Manager and Project Manager.
1.4.2. Always keep a posted and marked up set of plans and specifications convenient for ready reference.

1.4.3. Make sure that the construction contractor has this same information.

1.4.4. Anticipate the construction contractor's operations by reviewing the plans and specifications for each operation before it begins.

a) Discuss contract requirements in each Preparatory Phase Meeting with the construction contractor before each operation begins.

b) Highlight and/or make notes of those provisions which need special attention, such as:

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

i. Unusual requirements.

ii. Those which other contractors have overlooked.

iii. Repetitive deficiencies.

iv. Use the checklists in these guides to help find significant items in the plans and specifications.

1.5 QUALITY ASSURANCE

Evaluating overall project perform on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

1.5.1. INPUTS

Quality management plan, Result of quality control measurements, Operational definitions.

1.5.2. TOOLS AND TECH.

Quality planning tools and techniques, Quality audits.

1.5.3. OUTPUTS

Quality improvement.

2. LITERATURE REVIEW

2.1 GENERAL

Literature pertaining to similar studies conducted all over the world is collected from various sources to determine the feasibility and scope of the work. Similar studies undertaken
are as follows:

2.2 SUMMARY OF LITERATURE REVIEW

2.2.1. To determine the quality of building materials like soil, stone, brick, sand, cement, sand, aggregate, concrete, steel etc.
2.2.2. To determine the Soil Classification, Grain- Size Distribution, Moisture Content, Compaction characteristics, physical and chemical requirements for cement.
2.2.3. To determine the Sieve analysis, organic impurities, soundness, abrasion, deleterious materials, finer, alkali reactivity for stone aggregate.
2.2.4. Water-cement ratio, slump test, compressive test for concrete.
2.2.5. To determine tensile strength of steel and compressive strength of brick.

2.3 LITERATURES REVIEWED

2.3.1 Parsons has studied "construction quality control/quality assurance plan" in that Materials qualification testing will be done prior to construction to verify that the materials comply with requirements of the specifications. The contractor will obtain representative samples of the materials

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

designated as the proposed source of the materials. Test samples will be sent by the contractor to the Testing Laboratory. The Testing Laboratory will report all test results for determination of material meeting the acceptance criteria. For soils, sampling and analysis will be performed by the contractor on the onsite borrow material source. The CQAO or designee will periodically inspect material being used. If determined that the characteristics of the material being used differ from the material initially tested, the CQAO designees will direct the contractor to repeat the qualification testing. If the new material qualification test results meet the criteria of the technical specification as determined by the Engineer of

Record, the new materials may be used for the work; otherwise, previously approved materials must be used or other acceptable materials must be sampled and tested as noted above prior to incorporating into the work.

2.3.2 M. Dudek-Burlikowska*, D. Szewieczek "Quality estimation methods used in product life cycle" in that In Polish companies, quality of products is a result of many connected processes. Those processes are depended on the factors forming quality products requirements. At present time the organizations put "prevention strategy "which replaced "detecting strategy". This approach has influence on optimisation of production process and reduction of costs and spoilage. According to Quality Management System and Quality Control organization should use quality methods in the whole product life cycle. Such activities make it possible to apply the proposed model in continuous quality improvement.

2.3.3 Dr.Ibtisam M. A. Al.Hamidi & Manaf A.Mohammed "quality control of cost estimation process in construction organizations" in that Quality has been emerged in the 1980s as the top strategic issue in industry. Statistical process control (SPC) is an important element of total quality management (TQM).Though SPC techniques were originally developed for manufacturing; they have been successfully applied to certain administrative and service functions. The objective of this research is to demonstrate the applicability of SPC techniques for quality control and improvement in engineering organizations involved in construction (implementing projects). One of the most important processes to be controlled in construction projects (cost estimation process) has been focused on. The technique of controlling such a process has been defined depending on reviewing the subject in the previous studies. Adopting individual measurement charts is reached as the technique used to control this process statistically. Practical data, represented as a list of projects implemented in 2002 by the State Company for Transportation Projects together with their estimated and actual costs, have been obtained and considered for this purpose (through applying individual measurement charts as a suitable technique for controlling processes statistically) showing the applicability of SPC techniques in engineering construction organizations which undertake projects along long period of time. The conclusions reached from this research are: The application of SPC in Iraqi construction engineering organizations is extremely disregarded. [3] proposed a system, this fully automatic vehicle is equipped by micro controller, motor driving mechanism and battery. The power stored in the battery is used to drive the DC motor that causes the movement to AGV. The speed of rotation of DC motor i.e., velocity of AGV is controlled by the microprocessor controller. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on

physical input as the degree of mechanization is increased. Change in culture of the organization is required before SPC technique can be effectively used. Management commitment and training are very important in bringing about the cultural change. Control chart technique can bemused not only in industry but also in engineering organizations. This study has been dedicated to apply this technique in a construction engineering organization (on the Organization level); it has been found that this technique is Avery efficient tool to separate special causes from common causes of variance. It is possible to include further quality measures like cost and schedule measures beside the traditional ones (defect measures) to control quality in engineering organizations. Five projects (from 24) undertaken by SCTP have been discovered out of the control limits, which are approximately ±6.5 percent. The engineers in charge of those projects are advised to take action, and the management to make improvements to the estimation system, considering that as a policy, by reducing the limits to ±5.0 percent to eliminate or reduce the effect of the common causes. It is recommended to adopt SPC in all engineering, design and construction companies in Iraq to control and improve their processes.

2.3.4 Giselle lineman "the application of quality assurance in system implementation projects" Most system implementation projects fail because they do not realise their original purpose and consequently do not meet the requirements of users and organisations. Most often the reason for this is quality assurance not being implemented by the project team as well as non-adherence to quality standard guidelines. This research study therefore aims to determine how organisations apply quality standards during the implementation of quality assurance in their system implementation projects. A further aim is to determine what types of problems are experienced in the application of quality assurance by organisations that have implemented quality assurance in their system implementation projects. The literature review conducted focuses on what quality are, as well as the type of quality control standards and project management methodologies that are available. A review of the reasons for unsuccessful system implementation projects and quality initiatives also provides background on where organisations are going wrong. A qualitative research methodology, with multiple case studies, is applied in this research study. The results indicate that the organisations that participated in this research study did apply quality assurance methodologies during their system implementation projects. However, weaknesses existed that, if improved, could enhance the successful implementation of systems, the quality of the systems implemented, and the time frame in which systems are implemented. Based on the findings of the research study, the researcher has developed quality assurance model that can be used during system implementation/development projects. This model is divided into the various system development life cycle phases, such as the planning phase, design phase, development phase, etc, indicating the quality assurance activities and deliverables required during each of these phases. This approach makes the model unique in the sense that some or all of these phases can be adapted to any

Company's system development life cycle methodology to assist in identifying the activities and deliverables required for successful implementation/development of projects. The results from the research have indicated that weaknesses do exist within system implementation projects when looking at the QA activities performed to assist with the success of the project. Through the literature review conducted, it has-been found that even though guidance for QA activities exists in the form of models,

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

frameworks and standards, these are not specific enough to assist an organisation indentifying the specific QA activities needed during each

Phase of an SDLC. Furthermore, the results that have been obtained from thecae study indicate that the company whose business information system was implemented at the various organisations surveyed, does apply QA activities during their normal implementation projects. They also have not Yet had an unsuccessful implementation, although a lot of rework had to be done. This might not be the case for other organisations that have not yet adopted QA activities in their implementation strategies. Finally, it is hoped that if aqua model (as suggested in Figure 6-1) can be implemented successfully, it will assist organisations in their system implementation projects and ensure that systems are implemented according to specifications, within budget anon time.

2.3.5 Adenoma, Louie Florin has studied "Factors Affecting Quality in the Delivery of Public Housing Projects in Lagos State, Nigeria" in that the Research work delves into the origin of public housing in Lagos, Nigeria and its development over the years. It identifies the challenges of public housing but focuses on appraising the quality assurance practices in the construction industry. The objectives are to examine the factors that hinder effective quality assurance practices; and to ascertain who should be largely responsible for ensuring/enforcing effective quality assurance practices in public housing projects. In achieving the objectives, a field survey involving a sample size of 73 respondents, mainly the professionals in the built environment working directly with Lagos State and those managing the housing projects awarded to different contractors using structured question naives. The study reveals that the aims and objectives of quality assurance are easily compromised infrequently lost since it relies heavily upon the individual on tributions to implementation from each designer, contractor, supplier and sub-contractor. The study concludes that all have major roles to play in ensuring quality work in public housing projects; enforcement of quality standards by government agencies, setting up of quality assurance department in construction firms and enforcing statutory requirements as well as providing trainings and seminars on quality standard. Severe penalty for non compliance to quality standards be put in place by government and professional bodies. Clients must demand proof of contractors' credentials for quality assurance capability.

2.3.6 dottorato di ricerca, akram ahmed elkhalifa"the construction and building materials industries for sustainable development in developing countries" The construction industry (CI) in developing countries (DCs) faces multitude challenges Confronting its improved performance and development. Similar to many developing countries, the Sudan faces severe problems in its construction sector which should be seriously addressed and eliminated. Problems related to building materials (BMs)

Production, supply and management tend to dominate theist of impediments to the development of the Sudanese Construction Industry (SCI). The main objective of this study is to conduct a comprehensive and elaborate review and analysis of the construction and building materials industries in the Sudan focusing on locally produced building materials and building technologies employed in the provision of housing. The research aimed to delineate the significance of the construction industry in the socioeconomic development in the Sudan and to assess the potentials of the country in self sufficiency of key building materials. It reviewed the *status quo* of the Sudanese Construction Industry (SCI) and

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

the Sudanese Building Materials Industry (SBMI) by investigating the role of construction in the socio-economic development of the country. The study examined the causality relationship between construction and the economy as a whole and its subsectors employing statistical tests, namely the Granger causality test. Data pertaining to the performance of the Sudanese economy during 1982-2009 were employed forth analysis. The study explored the possibility of producing BMs locally in terms of raw materials availability and distribution.

2.3.7 N.C.D.C "Human Resource and Skill Requirements in the Construction Materials and Building Hardware Sector" Construction investment accounts for nearly 52.4% of the Gross Fixed Capital Formation. Investments in construction have a positive domino effect on supplier industries, thereby contributing immensely to economic development... Construction materials and equipment sector accounts for approximately8.6% of India's GDP1 and accounts for nearly two-third of the total construction costs on an average. The share of construction materials in project costs ranges from 40-60%and the corresponding cost for construction equipment ranges from 5 to 25%. Construction component comprises nearly 60-80%of project cost of infrastructure projects like roads, housing etc. In projects like power plants, industrial plants, etc. the share, though lower, is critical. Construction materials and equipment sector comprises of various sub-industries such as:

i. Cement
ii. Steel
iii. Construction equipment
iv. Paints & Chemicals
v. Petroleum products and resins
vi. Fixtures and fittings (including electrical wiring)
vii. Aggregates such as concrete and asphalt
viii. Timber
ix. Tile sand
x. Ceramics
xi. Aluminium, Glass & Plastics

2.3.8 "abdulaziz a. bubshait,1 member, asce, and tawfiq h. al-atiq2, iso 9000 quality standards in construction" There is risk involved in any construction project. A contractor's quality assurance system is essential in preventing problems and the reoccurrence of problems. This system ensures consistent quality for the contractor's clients. An evaluation of the quality systems of 15 construction contractors in Saudi Arabia is discussed here. The evaluation was performed against the ISO 9000 standard. The contractors' quality systems vary in complexity, ranging from an informal inspection and test system to a comprehensive system. The ISO 9000 clauses most often complied with are those dealing with

i. inspection and test status;
ii. inspection and
iii. testing;
iv. control of non conformance product; and
v. handling, storage, and preservation

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

3. SCOPE

The scope of this research is to reduce the risk and to avoid the problem in construction. In this manner it can satisfy the conditions of green buildings. It is also carried out to find the what are the test to be conducted in building material and to improve the quality of building construction.

4.METHODS AND MATERIALS

4.1 MATERIALS

The materials used for this study includes stone, brick, cement, fine aggregate, coarse aggregate, steel, concrete

4.1.1 Stone

The stone is always obtained from rock. The rock quarried from quarries is called stone. Quarried stone may be in the form of stone blocks, stone aggregate, stone slabs, and stone lintels. Here to be used as impact test, water absorption test, hardness test and crushing strength. It is preferred according to SP27-1987.

4.1.2 Brick

Brick is made up of soil and it is used to made the masonry structure Absorption test, Shape and size test**,** Crushing strength test, Soundness test, Hardness test. The bricks be table-moulded, well burnt in kilns, copper- coloured, free from cracks and with sharp and square edges The colour should be uniform and bright. The brick should uniform in shape and should be of standard size. The bricks should give a clear metallic ringing sound when struck with each other. It is preferred according to SP27-1987.

4.1.3 Cement

The most common cement used is Ordinary Portland Cement. The type I is preferred
according to IS: 269-1976, which is used for general concrete structures. 53 Grade ordinary Portland cement is confirming to 12269. Out of the total production, Ordinary Portland Cement accounts for about 80-90 percent.

Fineness of cement = 8%
Standard consistency of cement = 31%
Initial setting time of cement = 36 min
Specific gravity of cement = 3.46

4.1.4 Aggregate

Aggregates shall comply with the requirements of IS 383. As far as possible reference shall be given to natural aggregate. Aggregates are the important constituents in concrete. They give body to the concrete, reduce shrinkage and effect economy. One of the most important factors for producing workable concrete is good gradation of aggregates. Good grading
implies that a sample fractions of aggregates in required proportion such that the sample contains minimum voids. Samples of the well graded aggregates containing minimum voids require minimum

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

paste to fill up the voids in the aggregates. Minimum paste will mean less quantity of cement and Minimum paste will mean less quantity of cement and less water, which will further mean increased economy, higher strength, lower shrinkage and greater durability. Aggregate comprises about 55% of the volume of mortar and about 85% volume of mass concrete. Mortar consists size of 4.75mm and concrete contains aggregates up to
a maximum size of 150mm.The fractions from 80 mm to 4.75 mm are termed as coarse aggregates. Those fractions from 4.75 mm to 150 microns are termed as fine aggregates. For most work, 20 mm aggregates are suitable.
Specific gravity of fine aggregate = 2.38
Specific gravity of coarse aggregate= 2.71

4.1.5 Water

Water is an important ingredient of concrete as it actually participates in the chemical
reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully. Water used for mixing and curing shall be clean and free from materials like oils, acids, alkalis, salts, sugar,
organic materials or other materials that may be harmful to concrete or steel. pH value of the water used in concreting shall not be less than 6.

4.1.6 Steel

Steel is important ingredient of qualify structure and it is used to carry out the load easily from the structure to column and it is having high tensile strength. It is preferred according IS 800-2007.

5. PROPOSED OUTLINE FOR THE QUALITY CONTROL INSPECTION PROGRAM

A. Introduction
- Purpose
- Background
- Description of structures and types of construction
- Specialized construction techniques and equipment

B. Organization and Staffing Responsibilities
- Responsibilities of various organizations
- Number of staff and availability required
- Titles, duties and responsibilities of staff
- Specialty inspectors
- Lines of communication and authority
- Approval and rejection of work
- Authority to stop work
- Statement of independence
- Resumes

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

C. Inspection Plan and Field Practices
- Inspection criteria
- Knowledge of contract plans and specifications
- Inspection equipment and resources
- Contractor operations
- Coordination with contractor's schedule
- QCIP operations o Frequency of inspection
- Documentation and follow-up action
- Training
- Daily inspection reports
- Non conformance reports
- Other periodic reports
- Maintenance of records
- Photographs

E. Training
- Study materials
- Classroom instruction
- On-the-job-training and supervision
- Proficiency testing and certification
- Resume update

F. Material Testing o Testing schedule
- Testing standards
- Testing organization
- Adequacy of on-site laboratory
- Adequacy of off-site laboratory
- Evaluation of testing data and actions required
- Documentation

G. Erosion Control and Environmental Compliance
- Environmental compliance plan
- Erosion and sediment control plan
- License requirements
- Specialized plans, permits and approvals
- Frequency of inspections
- Documentation and corrective actions
- Environmental deficiency report

H. Schedule
- Start and finish dates
- Anticipated construction sequence
- Staged and phased construction

I. Planned Use of Consultants

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 8, March 2017

- Areas of inspection and review
- Consultants names and resumes

J. Appendices

- Organizational chart
- Descriptions of duties and responsibilities of QCIP staff
- QCIP personnel resumes
- Project layout
- List of contract documents
- Materials testing schedule and referenced documents
- Example of reports to be used, e.g. non conformance report
- Flow chart for tracking construction deficiency
- Contractor's schedule
- Record keeping procedures

6.RESULT AND DISCUSSION

6.1 WORK COMPLETED

- ❖ Selected the location of site
- ❖ Taken the survey of the land and drawn the plan by using auto cadd
- ❖ Collected the literature review
- ❖ Collected the requirement materials

6.2 WORK TO BE COMPLETED

- ✓ Testing to be our collected material
- ✓ To determine the quality of material such as soil, stone, brick, cement, aggregate, concrete and steel
- ✓ To estimate the cost of building
- ✓ Execute the quality control and assurance of building.

REFERENCES:

[1] Arauz, R., & Suzuki, H. (2004). ISO 9000 performance in Japanese industries. *Total Quality Management & Business Excellence*, 15(1), 3-33.

[2] Brace, I. (2004). *Questionnaire Design. How to Plan, Structure and Write Survey Material for Effective Marketing Research*. London: Kogan Page.

[3] Christo Ananth, M.A.Fathima, M.Gnana Soundarya, M.L.Jothi Alphonsa Sundari, B.Gayathri, Praghash.K, "Fully Automatic Vehicle for Multipurpose Applications", International Journal Of Advanced Research in Biology, Engineering, Science and Technology (IJARBEST), Volume 1,Special Issue 2 - November 2015, pp.8-12.

[4] Brown, A., Van der Wiele, T., & Loughton, K. (1998). Smaller enterprises experiences with ISO 9000. *International Journal of Quality and Reliability* Management, 15(3), 273-85.

[5] Bryman, A., & Cramer, D. (1994). *Quantitative Data Analysis for Social Scientists*. London: Routledge.

[6] Carlsson, M., & Carlsson, D. (1996). Experience of implementing ISO 9000 in Swedish industry. *International Journal of Quality and Reliability Management*, 13(7), 36-47.

[7] Chow-Chua, C., Goh, M., & Wan, T. B. (2003). Does ISO 9000 certification improve business performance. *International Journal of Quality and Reliability Management*, 20(8), 936-53.

[8] CIDB (2008). CIDB News. *Newsletter of the construction Industry Development Board Malaysia*.

[9] CIS 7 (2006). *Quality Assessment System For Building Construction Work*. Malaysia: Construction Industry Development Board

[10] Cohen, J. W. (1988). *Statistical power analysis for the behavioural science*. NJ: Lawrence Erlbaum Associates.

[11] Dawson, S., & Dickinson, D. (1988). Conducting international mail surveys: the effect of incentives on response rates within an industrial population. *Journal of International Business Sutdies*, 19, 491-496.

[12] Fuentes, C. M., Benavent, F. B., Moreno, M. A. E., Cruz, T. G., & Del Val, M. P. (2000). Analysis of the implementation of ISO 9000 quality assurance systems. *Work study*, 49(6), 229-41.

[13] Ghoshal, S., & Nohria, N. (1993). Horses for courses: organizational forms for multinational corporations. *Sloan Management Review*, 34, 23-35.

[14] Gotzamani, K. D., & Tsiotras, G. D. (2002). The true motives behind ISO 9000