

## Quality Assurance Management Design Approach for Construction Project Management Special reference to Soil Testing works

– A. Chandramohan\*

Research scholar, Department of Management Studies, School of Commerce and Management, Bharath Institute of Higher Education and Research, Chennai, India

 ctechconstruction@gmail.com  <https://orcid.org/0000-0003-3725-5237>

– Ramya Thiagarajan

Associate Professor & Research Supervisor, Dept of Business Administration, Faculty of Arts and Science, Bharath Institute of Higher Education and Research – BIHER, Selaiyur, Chennai, India

 ramya.bba@bharathuniv.ac.in  <https://orcid.org/0000-0001-6486-5490>

– P. Srinivas Kumar

Professor, Civil Engineering & Director, School of Engineering & Technology, IGNOU, Maidan Garhi, New Delhi, India

 srinivask@ignou.ac.in  <https://orcid.org/0009-0000-4819-1270>



### ARTICLE HISTORY

**Paper Nomenclature:** Theme Based Paper (TBP)

**Paper Code:** GJEISV16I3JS2024TBP2

**Submission at Portal (www.gjeis.com):** 05-July-2024

**Manuscript Acknowledged:** 17-July-2024

**Originality Check:** 24-July-2024

**Originality Test (Plag) Ratio (Drillbit):** 05%

**Author Revert with Rectified Copy:** 04-Aug-2024

**Peer Reviewers Comment (Open):** 07-Aug-2024

**Single Blind Reviewers Explanation:** 18-Aug-2024

**Double Blind Reviewers Interpretation:** 25-Aug-2024

**Triple Blind Reviewers Annotations:** 03-Sept-2024

**Author Update (w.r.t. correction, suggestion & observation):** 05-Sept-2024

**Camera-Ready-Copy:** 18-Sept-2024

**Editorial Board Excerpt & Citation:** 26-Sept-2024

**Published Online First:** 30-Sept-2024

### ABSTRACT

**Purpose:** This study proposes the theoretical aspects of Quality Assurance Management System Design of construction and Infrastructure companies. It suggests cutting edge strategies and tools for better quality control and for stringent system controlling in construction project management.

**Design / Methodology / Approach:** This paper used PDCA Approach quality system design for Construction Company. It plans for gauging control in the entire life cycle of construction project management activities viz pre-construction planning, soil testing, design of architectural and structural, site construction activities, quality control of construction process, auditing and post construction. The documentation system with three tier architecture for construction and infrastructure is prescribed for better quality control.

**Findings:** This study suggests the steps of Quality Management System designing, system development, internal auditing by the in-house trained auditors and details of certification agencies to get the certificate like ISO 9000 Quality Management System / Green Building Certificate / Reliability Certificate. The study positions the hierarchical positioning of three tier documentation like Vision/ Mission/ Objective of top level documentation, procedures \ manuals of middle level documentation, and work instruction / guidelines of lower level documentation.

**Originality:** The originality of study is focusing on enhancing the system for assuring the quality of infrastructures like roads, bridges, flyovers etc. It mainly focuses on the residential / house building, because here a lot of problems are happening due to non-streamlined workforce employed. If a good system and quality is maintained in residential house building, the value of assets will be very much appreciated.

**Paper Type:** Theme Based Paper

**KEYWORDS:** Quality Assurance | Quality Management System | ISO 9001 | Soil Testing and Documentation

### \*Corresponding Author (Chandramohan)

- Present Volume & Issue (Cycle): Volume 16 | Issue-3 | Jul-Sept 2024
- International Standard Serial Number: Online ISSN: 0975-1432 | Print ISSN: 0975-153X
- DOI (Crossref, USA) <https://doi.org/10.18311/gjeis/2024>
- Bibliographic database: OCLC Number (WorldCat): 988732114
- Impact Factor: 3.57 (2019-2020) & 1.0 (2020-2021) [CiteFactor]
- Editor-in-Chief: Dr. Subodh Kesharwani
- Frequency: Quarterly
- Published Since: 2009
- Research database: EBSCO <https://www.ebsco.com>
- Review Pedagogy: Single Blind Review/ Double Blind Review/ Triple Blind Review/ Open Review
- Copyright: ©2024 GJEIS and it's heirs
- Publishers: Scholastic Seed Inc. and KARAM Society
- Place: New Delhi, India.
- Repository (figshare): 704442/13

GJEIS is an Open access journal which access article under the Creative Commons. This CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0>) promotes access and re-use of scientific and scholarly research and publishing.



## Introduction

The International Organization for Standardization, or ISO, is a global organization with its headquarters located in Geneva, Switzerland. It is composed of numerous delegates from various commercial, industrial, and proprietary standard groups. All ISO standards are maintained by the Bureau of Indian Standards (BIS), an Indian partner of ISO, the National Standard Body. The current system should be examined in order to obtain ISO certification, and organizations should be guided in developing their activities to meet the requirements of international standards. The baseline requirement standard is IS/ISO/9000, and additional guidelines are available to enhance organizational-specific requirements. Organizations cannot obtain certification from the ISO itself. All certifications are completed by outside agencies.

Any corporate organization, including those in the manufacturing, service, financial, educational, political, profit-making, and non-profit service-minded sectors, can use this ISO standard. Since not all of the data is easily accessible in organizations, the trainer must conduct more thorough research in order to implement organizational design. The organization's efficacy and efficiency are determined by a number of elements, including behavior analysis, sociological aspects, and psychological aspects of the stakeholders.

## Significance

As organizations grow more and more, the challenges in the external and internal environments become more complex in business processes, structures and systems. Organizations need to redesign themselves periodically to meet the changing requirement. If not done, they face the problems; (1) Breakdowns and non-value-added steps; (2) Disintegrated/Fragmented work; (3) No customer centric approach; (4) Silo mentality; (5) Lack of ownership; (6) Cover up and blame rather than identifying and solving problems; (7) Delays in decision-making; (8) Blaming front line alone; (9) It takes a long time to get something done; (10) Systems are ill-defined or reinforce wrong behaviors

## Objectives of the Study

- ✓ To create Organizational Design for Construction Project Management
- ✓ To get Inspection standard for Soil Testing Works
- ✓ To make a soil test report.

## Need of Study

QMS integrates the people with core business processes, technology and systems. A well-designed QMS organization ensures that the organization matches its purpose and strategy. It significantly increases the likelihood of the collective efforts of people in the organization.

In organizations, the following activities to be done;

- 1) Study the organizational Work flow
- 2) Mapping for organizational Activities
- 3) Developing the organizational Chart
- 4) Identify the key departments in the Organization
- 5) Assigning Roles and responsibilities
- 6) Implementation of process approach
- 7) Controlling the Work flow
- 8) Standardize the organizational Work Flow
- 9) Monitoring the effectiveness and Efficiency
- 10) Maintaining Continual Improvement.

## Literature Review

(Atkinson, G., 2005) One of the goals of standardization is quality. A building's or other construction's overall quality is the sum of its characteristics that allow it to carry out a task or meet a specific purpose in a reasonable amount of time. Even if a good product is necessary for a building or civil engineering project, it is not enough on its own. It needs to be properly integrated into the structure and design. Defects and failures in buildings are more often caused by inadequate treatment of a specific product during design and construction than by flaws in the products themselves. Quality management has evolved from responding to the results of site production activities to becoming a strategic business function that serves as a deterrent for construction enterprises, according to another researcher.

(Harris, F., and others, 2001). A construction company cannot successfully compete in the current construction industry unless it can assure its clients of a high-quality product. If correctly implemented, formal quality management systems offer a means of attaining quality (i.e., compliance to defined requirements) (Battikha, M.G., 2002a). "The organizational structure, responsibilities, procedures, processes, and resources for implementing quality management" is how the researcher defined a quality system. To put it simply, quality management systems include prevention and evaluation and refer to the quality activities that go into creating a product, process, or service. It is defined as "a management discipline concerned with preventing problems from occurring by creating the controls to make prevention possible".

(Battikha, M.G., 2002a) Quality activities include establishing the policy, goals, and duties for quality and putting them into practice within the system through quality planning, quality assurance, quality control, and quality improvement. Getting things right the first time is the foundation of the significance of quality assurance. A construction firm can achieve and profit from having a Quality Assurance System in

place by putting it into place, keeping it up to date, reviewing it, and making continuous improvements. The level of client unhappiness over an extended length of time and the industry's growing frustration with certain of their advisers to attain value for money are the reasons behind quality assurance. A growing number of construction enterprises are likewise annoyed by the insufficiency of a system that, despite their best efforts, falls short in certain areas.

Building assembly has undergone a revolution, moving from a craft process to one in which semi-skilled labor from numerous independent employers primarily performs the crucial task of linking interdependent elements. This puts a lot of strain on management and supervisory systems. A quality system is intended to give clients the guarantee—backed up by records—that all contracts will be fulfilled within the predetermined parameters of time, money, and quality. Additionally, it should guarantee that important suppliers, subcontractors, and staff are aware of and fully satisfy customer expectations.

It is frequently believed that quality assurance and quality control detection serve prevention (Harris F. & McCaffer R., 2001). However, a control that is put in place to identify failures before they happen serves prevention by, for example, lowering the tolerance band to well inside the specification limits. The product is altered by quality control, not by quality assurance. Quality control, as described by the researcher, is a collection of procedures or methods used to make sure that all quality standards are being fulfilled. Processes are tracked and performance issues are resolved to accomplish this goal.

To inspect, record, and fix flaws, the inspector, engineer, contractor, funding agency, permit agency, and system staff must collaborate. According to the researcher, there is no one definition of quality improvement or strategy that is more effective than another (Health Foundation, 2009). Nonetheless, there are several definitions that characterize quality improvement as a methodical process that employs particular methods.

The manner in which the change is introduced and implemented is the most crucial component of a successful and long-lasting improvement. ISO 9000:2000 defines quality improvements as “A component of quality management that focuses on improving the capacity to meet quality standards.” Numerous quality improvement techniques are typical among non-residential builders and developers, according to empirical research on quality management in the construction industry. “Total Quality Management” is a successful management philosophy that encompasses the majority of these methods.

Jorge Benzaquen, Mariene Carlos, Gerado Norero, Heber Armas, and Hidebrando Pacheco's article Quality in Private Health Companies in Peru: The Relation of QMS ISO 9000 principles on TQM Factors was published in the

International Journal of Healthcare Management 14(2)311-319 in 2021.

In 2020, Tajammal Hussain, Jacob Kjeer Eskildsen, and Rick Edgeman published The Intellectual Structure of Research in ISO 9000 Standard series (1987-2015): A Bibliometric Analysis in the Journal of Total Quality Management & Business Excellence 31(11-12) 1195-1224.

ISO 19011:2018 Guideline for Auditing Management Systems

ISO 9004: 2018 Quality Management – Quality of an organization – Guidance to achieve sustained success (continuous improvement)

## Research Design

Research Design in Organizational System Design

**QMS:** The Quality Management System (QMS) plays a central to the ISO 9001 standard and based on principle of process approach.

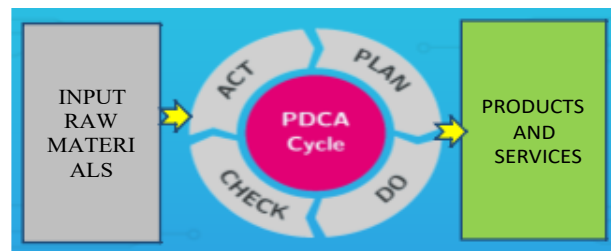


Figure 1: Quality Management System

For this a set of principles, guidelines, operating procedures are to be developed to measure the “Quality” of various aspects of business. QMS four core elements :

- (1) Plan;
- (2) Do;
- (3) Check; and
- (4) Act to be mapped in the process as shown in figure 1.

QMS is not designed to define product quality, but for the system. It is based on the concept “if the process is good, then the product should be too “. In other words ISO 9001 is a process focused standard, as opposed to a product-focused standard.

This system design will give the value money, customer satisfaction and continual improvement.

### Organizational Design Cycle for Construction Company

The organisational system design cycle will give the value money, customer satisfaction and continual improvement.

### Eligibility to get ISO 9001 certificate:

ISO 9001 certification is available to every organization. The organization's size is irrelevant. One person working or a hundred thousand people working could be involved. No matter what industry is executing the work, it is a general standard for QMS.

Additionally, individuals can earn their ISO 9001 certification.

## Procedure for getting ISO 9001 certificate

### Documents to be developed

The organization must adopt a quality management system in accordance with the most recent ISO 9001 standard in order to receive an ISO 9001 certificate. The ISO QMS documents listed below must be created:

Implement the system in compliance with established standards and build the QMS in line with the most recent ISO standard. A Certification Body will conduct audits to evaluate the QMS's performance. The certificate will be granted if the QMS satisfies the standard requirements. To keep the certificate, re-certification will be required after three years.

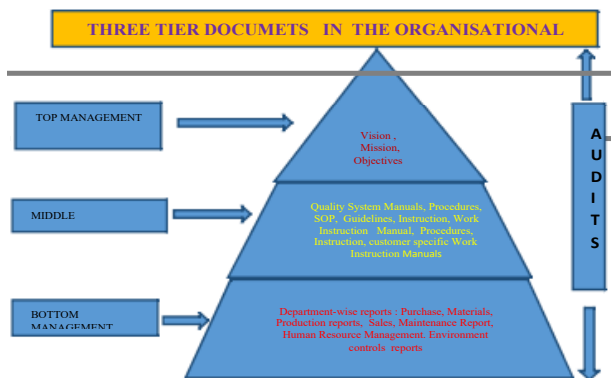


Figure 2: QMS Documentation Development

### The sections of ISO 9000 to be addressed in QMS Documentation development as shown in figure 3.

The ISO QMS 9001 standard as defined by the ISO is split up into 10 sections. They are given below:

#### Introduction, references, & definitions

It covers largely details about introductory, containing general information about the organization's goals as well as references for ISO terms and definitions.

#### Context of the organization

This section covers the organization in its current context. It refers to internal and external issues and interested parties and stakeholders in the organization.

### Leadership

It gives about structurally defined various decision makers in the organization to implement the QMS. It covers specific roles and responsibilities, and how to do the process and ways to implement the QMS.

### Planning

It outlines risks and opportunities for implementing the QMS. Objectives and Procedures to achieve for improvement in the organization. Strength, Weakness, Opportunity and Threat (SWOT) analysis and aligning objectives for improvement in the planned work.

### Support

Allocation of resources in the design and implementation of the QMS including human resources, buildings, infrastructure, work environments, organizational knowledge, monitoring, and tracking resources.

### Operation

This section deals with everything relating to the planning and deployment of products or services within the organization. In this section planning, requirements of product feature, product design details, review methods, and service related activities are to be covered for business operations.

### Performance evaluation

This details everything necessary for analyzing performance of the QMS. Covers all process parameters, quantifying and assessing customer satisfaction, performing internal performance audits, and the ongoing review of the QMS itself.

### Improvement

This is final section is everything necessary for the continuous improvement of the QMS. This includes process assessments and taking corrective action for those who are not meeting the requirements.

## Certification Benefits

### Benefits on overall business:

Profit potential, brand image, credibility and market share are increased. Efficient resource management obtained. By Integration and process automation, manual work is reduced. Organizational efficiency effectiveness is improved by using data and evidence to inform decision making.

### Benefits to customers:

Products are reliable, high quality. The prime focus of customer satisfaction by identifying their needs and goals.



## Benefits to employees

Job security, higher job satisfaction, company culture, worker morale, Training and workplace happiness are improved because of systematic development. Because of employees' involvement more and they feel more responsible for the process's continuous improvement. Decisions making on a specific process are allowed and goals of the organization are achieved.

## Certification Bodies

Generally ISO does not issue certificates. Third party certification bodies do Audits based on the standard requirements and issue the certificates. Some of the auditing bodies are given below:

- 1) Bureau of Indian Standards (The National Standards Body of India) Manak Bhavan, No : 9, Bahadur Shah Zabar Margs, New Delhi-110002. Telephone No: + 91 11 23231842, Email : mscd@bis.org.in
- 2) International Accurate Certification, 211,2<sup>nd</sup> Floor, SG Shopping Mall, D.C. Chowk, Sector -9, Rohini, Delhi -110085.
- 3) TUV Rheinland India Pvt. Ltd. I-Thum, Office No: 309, III Floor, Tower A, A-40. Sec .62. Noida- India
- 4) TUV Sports Land Overseas Pvt., Ltd., A-17, Udayarpuram, Industrial area Partapur, Dehli Road, Meerut- 250103, UP, India
- 5) BMQR Certifications Private Limited, No: 5, Second Floor, Sathyamoorthy Road, Anna Nagar West, Chennai, India 600040

## Type of audits:

### Internal Audit:

As per QMS Standard, the Internal Audit will be done internally by company employees who are trained in the Internal Audit training programme. The internal audit of the cross fictional team will be allotted to do the audit. During the audit the audit check list will be used to carry out the audit .On result of the audit Non Conformance report will be raised to indicate the deviation as per the quality management standard. The corrective action and preventive action to be written for non-conformance raised.

This is to be done in the periodic manner with records like minutes, audit reports, Non-conformance reports, management review minutes (MRM) and etc.

### External Audit:

As per the QMS developed documentations and ISO Standard the external audit will be done by certification body.

Adequacy audit and compliance audit will be done in the pre-certification period. The adequacy is to assess ISO Clauses interpretation according to core activity of the organization and the compliance audit for assessing the compliance in the process.

Then certification audit will be conducted based on the ISO Clauses and QMS Developed in the organization. NCR will be raised for the identified Nor-conformance. NCR reports should be closed with Corrective and Preventive action taken for the before the Surveillance audit. Surveillance will be conducted in the post-certification period to ensure the system survival. The surveillance audits will be done in the post certification period for the three years in the periodical manner.

## Research Design in Soil Testing with Soil Test Report Details

The representative soil samples collected from the bore hole were visually identified, and classification and identification tests (Liquid and Plastic Limit tests on clayey soil samples and Grain Size Analysis of sandy and gravelly soil samples) were conducted..

Chemical analysis was carried out on the ground water sample collected from Bore Hole and the results are presented in Table. The results of Chemical analysis received from Italab Private Limited, Chennai are reproduced in Annexure 1.

## Subsoil Conditions

The data presented in Fig. 2 and Tables 1 to 4 shows the following subsoil conditions.

- (i) The top layer is Debris Filling, 0.3 m thickness.
- (ii) A layer of clayey sand, the clay content being of very low plasticity, then occurs from 0.3 m to 2.7 m, the soil being:
  - Very loose: From 0.3 m to 0.9 m
  - Loose: From 0.9 m to 1.85 m
  - Medium dense: From 1.85 m to 2.7 m
- (iii) A layer of very stiff, sandy clay of medium plasticity then occurs from 2.7 m to 3.85 m
- (iv) A layer of hard, sandy clay of high plasticity then occurs from 3.85 m to 6.1 m
- (v) Very Hard Stratum occurs at a depth of 6.1 m.

## Ground Water Table

At the time of soil investigation Groundwater table was met with, at a depth of 3.3 m in the Bore Hole, during boring.

### Chemical Composition of Groundwater

The results of chemical analysis of the water sample presented in Tables show that:

- (i) the groundwater is slightly Alkaline (pH value being more than 8). Since the pH value is not less than 6, the groundwater, in terms of pH value, is suitable for mixing concrete as per Clause 5.4.2 of Indian Standard: 456-2000, (Reaffirmed 2005), PLAIN AND REINFORCED CONCRETE – CODE OF PRACTICE (Fourth Revision).
- (ii) The chloride content is less than the permissible upper limit of 500 mg/l. for use of ground water for mixing in concrete for RCC, as per IS: 456-2000, (Reaffirmed 2005). Therefore, in terms of chloride content in the ground water, the groundwater is suitable for mixing concrete for RCC.
- (iii) The sulphate content (expressed as  $SO_3$ ) is also less than the permissible upper limit of 400 mg/l for use of ground water for mixing in concrete, as per IS: 456-2000 (Reaffirmed 2005). Therefore, in terms of sulphate content also, the groundwater is suitable for mixing concrete for RCC.
- (iv) The sulphate content (expressed as  $SO_3$ ) is in the range of 0 to 300 mg/l which comes under Class 1 of “Requirements for concrete exposed to sulphate attack”, as per IS:456-2000, Table-4. For this Class, the requirements are: “Ordinary Portland cement or Portland slag cement or Portland pozzolana cement can be used with a minimum cement content of 280 kg/ m<sup>3</sup> of concrete and with maximum free water: cement ratio of 0.55”
- (v) Free acidity: To neutralize a 100 ml sample of water, using phenolphthalein as an indicator, it should not require more than 5 ml of 0.02 normal NaOH. The actual results are Nil. Therefore, the groundwater is suitable for mixing concrete, in terms of free acidity. Alkalinity: To neutralize 100 ml sample of water, using methyl orange indicator, is also less than the permissible limit of 25 ml of 0.02 N HCl. Therefore, the groundwater is suitable for mixing concrete, in terms of Alkalinity
- (vi) Organic matters are also less than the permissible limit of 200 mg/lit.
- (vii) Inorganic solids are also less than the permissible limit of 3000 mg/lit.
- (viii) Total suspended matters are also within the permissible limit of 2000 mg/lit.

Therefore, the groundwater is suitable for mixing concrete.

### Recommendations for Suitable Type of Foundation

On the basis of the results of the soil investigation carried out, the following are recommendations for suitable type of foundation for the proposed Construction of Residential Building Taking into account the subsoil conditions described in Sl. No. 4 above, Open Foundations (Individual column footings; or Combined footings if there are two or more columns close to each other; or Strip Raft combining each row of columns, if each row of columns are close to each other when compared to the distance or span between rows of columns; or Raft foundation are recommended.

- (i) It is strongly recommended to compact the loose clayey sand occurring within the top 1.85 m depth below the existing ground level, using a vibratory plate or preferably an earth rammer (see Enclosure 1 for Earth Rammer), so that settlements of the stilt floor flooring can be minimized
- (ii) Excavation shall be made up to a depth of at least 2.1 m below the ground level which existed at the time of soil investigation, for all Foundations, irrespective of the importance of the column or the loading on the column.
- (iii) After watering and thorough compaction of the bottom of excavation, using a vibratory plate or preferably an earth rammer (see Enclosure 1 for Earth Rammer), a layer of hard core, 200 mm thickness shall be laid. The hard core layer shall be at least 200 mm wider on each of the four sides of the column footings/combined footings or on each of the two sides of the strip raft. Specifications for the hard core layer are given in Enclosure 2.
- (iv) PCC for the foundations can then be laid on the hard core layer, which will be at 1.9 m depth below the ground level which existed at the time of soil investigation.
- (v) A safe bearing capacity of 15 t/m<sup>2</sup> is recommended under the foundations. It may be noted that the pressure on the soil at the bottom of the hard core layer will be much less than 15 t/m<sup>2</sup>, since the hard core layer will spread the load on a much larger area of the soil than the area of foundation. However, the width of any foundation shall not be less than 1 m.
- (vi) At the time of excavation for foundations, if ground water table occurs within the recommended depth of excavation, sumps may be made to an additional depth of 0.3 m at one or more corners of the foundation pits for column footings/combined footings or at desired locations along the periphery of excavation for strip raft or raft foundation, and the water collected in the sumps may be bailed out. At the time of laying the hard core layer, the bottom of excavation shall be relatively dry (not slushy). Dewatering shall be maintained until that part of the concrete in the foundations, which comes below the ground water table level, sets.



- (vii) The excavated clayey sand can be used for backfilling of foundations. Backfilling shall be done in layers of not more than 200 mm thickness, each layer. Each 200 mm thick layer shall be well compacted (mere spreading the backfill material for backfilling is not adequate. Layered compaction shall be done for back filling).
- (viii) Pre-cast concrete slabs of about 0.5 m x 0.5 m with joints of about 15 mm filled with sand and bitumen mixed together or paver blocks are recommended for the stilt floor flooring. As and when settlements become very significant under the stilt floor flooring, the pre-cast concrete slabs or paver blocks will have to be removed, the undulations made good by filling sand and stone chips, well compacting the same and then the pre-cast concrete slabs or paver blocks are put back.
- (ix) It is recommended to design a relatively rigid framed structure for the proposed Building, so that any differential settlements within the Building area will not have any significant effect on the Building structure. It is recommended to tie all the grade beams to contain any differential settlements, which are likely to take place, between the column footings.
- (x) It is recommended to remove any organic matter or plants with roots, if present in the Plot, and then thorough compaction of the soil shall be carried out, using a vibratory plate or an earth rammer (please see Enclosure 1 for earth rammer), before placing Pre-cast concrete slabs or paver blocks for the stilt floor flooring.

**Table 1 Results of Cone Penetration Test**

Depth (m)	Test Value	Depth (m)	Test Value
0.00-0.05	Debris Filling	1.50-1.55	2
0.05-0.10		1.55-1.60	3
0.10-0.15		1.60-1.65	4
0.15-0.20		1.65-1.70	3
0.20-0.25		1.70-1.75	2
0.25-0.30		1.75-1.80	2
0.30-0.35		4	1.80-1.85
0.35-0.40	2	1.85-1.90	3
0.40-0.45	1	1.90-1.95	3
0.45-0.50	1	1.95-2.00	4
0.50-0.55	1	2.00-2.05	4
0.55-0.60	1	2.05-2.10	4
0.60-0.65	2	2.10-2.15	4
0.65-0.70	1	2.15-2.20	3
0.70-0.75	2	2.20-2.25	4
0.75-0.80	1	2.25-2.30	3
0.80-0.85	1	2.30-2.35	4
0.85-0.90	1	2.35-2.40	4
0.90-0.95	2	2.40-2.45	4
0.95-1.00	2	2.45-2.50	4
1.00-1.05	1	2.50-2.55	4
1.05-1.10	2	2.55-2.60	4
1.10-1.15	2	2.60-2.65	4
1.15-1.20	2	2.65-2.70	6

Depth (m)	Test Value	Depth (m)	Test Value
1.45-1.50	2	2.95-3.00	6
2.10-2.15	4	3.50-3.55	9
2.15-2.20	3	3.55-3.60	8
2.20-2.25	4		
2.25-2.30	3		
2.30-2.35	4		
2.35-2.40	4		
2.40-2.45	4	3.60-3.65	10
2.45-2.50	4	3.65-3.70	9
2.50-2.55	4	3.70-3.75	9
2.55-2.60	4	3.75-3.80	8
2.60-2.65	4	3.80-3.85	8
2.65-2.70	6	3.85-3.90	11
2.70-2.75	4	3.90-3.95	10
2.75-2.80	6	3.95-4.00	11
2.80-2.85	6	4.00-4.05	13
2.85-2.90	6	4.05-4.10	15
2.90-2.95	7	4.10-4.15	14
2.95-3.00	6	4.15-4.20	16
3.00-3.05	6	4.20-4.25	14
3.05-3.10	6	4.25-4.30	16
3.10-3.15	6	4.30-4.35	11
3.15-3.20	6	4.35-4.40	13
3.20-3.25	7	4.40-4.45	13
3.25-3.30	6	4.45-4.50	11
3.30-3.35	7	4.50-4.55	13
3.35-3.40	6	4.55-4.60	16
3.40-3.45	7	4.60-4.65	19
3.45-3.50	8	4.65-4.70	18
		4.70-4.75	17
		4.75-4.80	17
Depth (m)	Test-1	Depth (m)	Test Value
4.80-4.85	15	5.70-5.75	18
4.85-4.90	18	5.75-5.80	19
4.90-4.95	17	5.80-5.85	17
4.95-5.00	15	5.85-5.90	16
5.00-5.05	15	5.90-5.95	18
5.05-5.10	15	5.95-6.00	19
5.10-5.15	15	6.00-6.05	21
5.15-5.20	16	6.05-6.10	23
5.20-5.25	18	6.10-6.15	25*
5.25-5.30	19	6.15-6.20	26*
5.30-5.35	21	6.20-6.25	28*
5.35-5.40	20	6.25-6.30	25 for 4 cm*
5.40-5.45	20		
5.45-5.50	21		
5.50-5.55	20		
5.55-5.60	19		
5.60-5.65	19		
5.65-5.70	19		

\* Very Hard Stratum

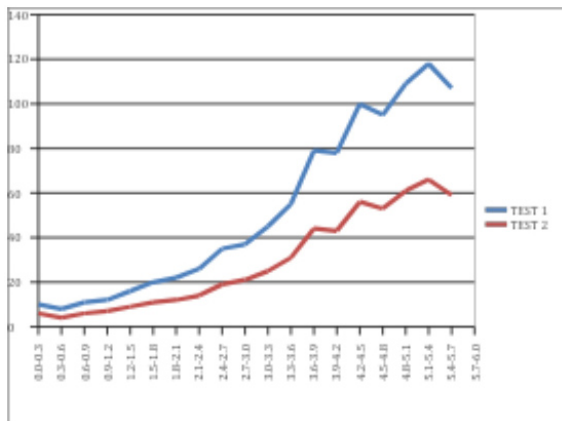
The results cone penetration test as shown in Table 1. The results of the cone penetration test of soil investigation recommended a suitable type of foundation for the proposed construction for residential building.

**Table 2 Comparison of results of Cone Penetration Test and equivalent Standard Penetration Test (spt) values, at different depths (no. of blows for every 300 mm penetration)**

Depth (m)	Cone Penetration Resistance (CPR) = No. of blows for 300 mm penetration	Equivalent SPT Values
		Test-1
0.0-0.3	Debris Filling	Debris Filling
0.3-0.6	10	06
0.6-0.9	08	04
0.9-1.2	11	06
1.2-1.5	12	07
1.5-1.8	16	09
1.8-2.1	20	11
2.1-2.4	22	12
2.4-2.7	26	14
2.7-3.0	35	19
3.0-3.3	37	21
3.3-3.6	45	25
3.6-3.9	55	31
3.9-4.2	79	44
4.2-4.5	78	43
4.5-4.8	100	56
4.8-5.1	95	53
5.1-5.4	109	61
5.4-5.7	118	66
5.7-6.0	107	59
6.0-6.3	148 for 29 cm*	82 for 29 cm*
Date of test	27.09.2018	

\* Very Hard Stratum

**Graphical Presentation - Comparison of Results**



**Figure 3: The graphical presentation – comparison of results as shown in figure 3.**

## Comparison

The results of cone penetration Test Values and equivalent standard penetration test values at different depths were compared. It shows that cone penetration resistance values better than equivalent standard penetration values

## Conclusion

Nowadays the organizations are forced to gain competitive advantage of cost, quality and service in on-time deliveries. For meeting these requirements Quality Assurance System, and Quality Management System like ISO 9000 certification gives the strategic ways for construction companies. Since the inception of ISO 9000 Standards in 1987 and further remarkable developments have happened up to the latest release. QMS with three tier architectural system development and its documentation developments gives good results for construction companies. With this guidance of the paper the construction companies can march towards intellectual structure, dynamic system design, summative knowledge in process design approach and futuristic customer development, etc. This research explains the ways for construction companies to get ISO 9000 certification right from base level to certification level.

## Opportunity for Future Development

There are wide opportunities for future development after ISO QMS Certification. This is baseline standard give details about the end to end organizational activities. After this they may go for further specific quality improvement according to requirements. Some of them are given below:

**Table 3: Specific quality improvement**

Improvement Tools	Details	Application area
RCA	Root cause analysis	Any problem solving area
FMEA	Failure Mode Effect Analysis	New product design
	Identification of Potential Failure MCode in the process.	Under process works
5S	Sort, Set in order, Shine, Standardize and Sustain	Identification and traceability
6Sigma	DMAIC- Define, measure, analyze, improve, Control	Reducing manufacturing defects
Lean	It is the production method to reduce the time with in production system	Lean manufacturing



## Limitations

If the ISO System is not followed properly and Audits are not conducted, the effectiveness and efficiency will be lost in the organization.

## Journal References

- Atkinson, G. (2005). *Construction quality and quality standards: The European perspective*. London: E & FN Spon.
- Battikha, M. G. (2002). Quality management practices in highway construction. *Emerald*, 532–550.
- Benzaquen, J., Carlos, M., Norero, G., Armas, H., & Pacheco, H. (2021). Quality in private health companies in Peru: The relation of QMS & ISO 9000 principles on TQM factors. *International Journal of Healthcare*, 14(2), 311–319.
- Cai, S., & Jun, M. (2018). A quantitative study of the internalization of ISO 9000 standards: Linkage among firms' motivation, internalization process, and performance. *International Journal of Production Economics*, 196.
- Harris, F., & McCaffer, R. (2001). *Modern construction management* (5th ed.). London: Blackwell Publishing.
- Health Foundation. (2009). *A review of the evidence of which improvements to quality reduce cost to health service providers* (p. 8). London.
- Hussain, T., Eskildsen, J. K., & Edgeman, R. (2020). The intellectual structure of research in ISO 9000 standard series (1987–2015): A bibliometric analysis. *Total Quality Management & Business Excellence*, 31(11–12), 1195–1224.
- ISO 9000 Series of Standards References
- ISO 19011:2018 Guideline for Auditing Management Systems
- ISO 9004: 2018 Quality Management – Quality of an organization – Guidance to achieve sustained success
- ISO 9000:2015: Quality Management System – Fundamental Vocabulary (definitions)
- ISO 9001:2015: Quality Management Systems – Requirements
- Jasiulewicz-Kaczmarek, M. (2016). Quality management principle as the framework for a maintenance management system. *ISO 9000*.
- Kakouris, A. P., & Sfakianaki, E. (2018). Impacts of ISO 9000 on Greek SMEs' business performance. *International Journal of Quality and Reliability Management*.
- Kakouris, A., & Sfakinaki, E. (2019). Motives for implementing ISO 9000—Does enterprise size matter? *International Journal of Productivity and Performance Management*.
- Shi, Y., Lin, W., Chen, P.-K., & Su, C.-H. (2019). How can the ISO 9000 QMS improve the organizational innovation of the supply chain? *International Journal of Innovation Science*.

### GJEIS Prevent Plagiarism in Publication

DELNET-Developing Library Network, New Delhi in collaboration with BIPL has launched “DrillBit : Plagiarism Detection Software for Academic Integrity” for the member institutions of DELNET. It is a sophisticated plagiarism detection software which is currently used by 700+ Institutions in India and outside. DrillBit is a global checker that uses the most advanced technology to catch the most sophisticated forms of plagiarism, plays a critical function for students and instructors and tag on a fully-automatic machine learning text- recognition system made for detecting, preventing and handling plagiarism and trusted by thousands of institutions across worldwide. DrillBit - Plagiarism Detection Software has been preferred for empanelment with AICTE and NEAT 3.0 (National Education Alliance for Technology) and contributing towards enhanced learning outcomes in India. On the other hand software uses a number of methods to detect AI-generated content, including, checking for repetitive phrases or sentences and AI-generated writing. As part of a larger global organization GJEIS (www.gjeis.com) and DrillBit better equipped to anticipate the foster an environment of academic integrity for educators and students around the globe. DrillBit is GDPR compliant with privacy by design and an uptime of 99.9% and have trust to be the partner in academic integrity (<https://www.drillbitplagiarism.com>) tool to check the originality and further affixed the similarity index which is {05%} in this case (See below Annexure 16.3.4). Thus, the reviewers and editors are of view to find it suitable to publish in this Volume 16, Issue-3, Jul-Sept 2024.

## Annexure 16.3.4

Submission Date	Submission Id	Word Count	Character Count
24-July-2024	3332193 (DrillBit)	5091	32899

Analyzed Document	Submitter email	Submitted by	Similarity
2.2 TBP2_Chandramohan_GJEIS Jul to Sept 2024.docx	ctechconstruction@gmail.com	A. Chandramohan	05%

## DrillBit

### DrillBit Similarity Report

<b>5</b>	<b>7</b>	<b>A</b>	A-Satisfactory (0-10%) B-Upgrade (11-40%) C-Poor (41-60%) D-Unacceptable (61-100%)
SIMILARITY %	MATCHED SOURCES	GRADE	
LOCATION	MATCHED DOMAIN	%	SOURCE TYPE
2	pdfcookie.com	3	Internet Data
5	sde.uoc.ac.in	1	Publication
6	www.iso-9001-checklist.co.uk	1	Internet Data
7	pdfcookie.com	<1	Internet Data

8	byjus.com	<1	Internet Data
9	oa.up2china.com	<1	Internet Data
10	docplayer.net	<1	Internet Data

### EXCLUDED SOURCES

1	repository.futminna.edu.ng8080	3	Publication
3	www.ijlret.com	1	Publication
4	Quality Systems A Thermodynamics-Related Interpretive Model by Lollai-2017	1	Publication

### Reviewers Memorandum



**Reviewer's Comment 1:** The study provides an insightful examination of the design for Quality Assurance Management Systems for building projects, with a particular emphasis on soil testing. Nonetheless, several portions, especially those pertaining to technique and conclusions, could need some work in terms of organization and clarity. Readability and understanding would be improved with more thorough explanations and smooth transitions between the many stages of quality management (such as pre-construction, soil testing, and post-construction).

**Reviewer's Comment 2:** The study involves creating quality systems, the Plan-Do-Check-Act (PDCA) approach is a perfect match for the methodological framework. On the other hand, the study would be improved by the inclusion of case studies or examples from the real world that demonstrate how the PDCA cycle has been effectively implemented in actual construction projects. This would have the effect of increasing the relevance of the study and providing empirical evidence for the quality control measures that were recommended.

**Reviewer's Comment 3:** The study provides an original viewpoint on the importance of assuring quality in residential and infrastructure construction projects. Even if the emphasis on hierarchical documentation is important, it would be advantageous to do a comparison that is more comprehensive with the quality assurance standards that are now in place in the business. It is recommended that the suggested plan incorporate either benchmarking against global standards or industry best practices in order to more thoroughly verify the approach.

### Editorial Excerpt



The article has 05% of plagiarism which is the accepted percentage as per the norms and standards of the journal for publication. As per the editorial board's observations and blind reviewers' remarks the paper had some minor revisions which were communicated on a timely basis to the authors (Chandramohan, Ramya, and Srinivas), and accordingly, all the corrections had been incorporated as and when directed and required to do so. The comments related to this manuscript are noticeably related to the theme "Quality Assurance Management Design Approach for Construction Project Management Special reference to Soil Testing works" both subject-wise and research-wise. This paper emphasizes the importance of Quality Assurance Systems and ISO 9000 certification in helping construction organizations realize cost, quality, and service benefits. Information about ISO 9000 standards and the three-tier documentation architecture is helpful. The research might use additional examples or case studies of how construction firms would certify these tactics in practice. More insight on ISO 9000 implementation challenges and solutions would make the study more realistic. After comprehensive reviews and the editorial board's remarks, the manuscript has been categorized and decided to publish under the "Theme Based Paper" category.

### Acknowledgement



The acknowledgement section is an essential part of all academic research papers. It provides appropriate recognition to all contributors for their hard work and effort taken while writing a paper. The data presented and analyzed in this paper by the authors (Chandramohan, Ramya, and Srinivas) were collected first handily and wherever it has been taken the proper acknowledgment and endorsement depicts. The author is highly indebted to others who facilitated accomplishing the research. Last but not least, endorse all reviewers and editors of GJEIS in publishing in the present issue.

### Disclaimer



All views expressed in this paper are my/our own. Some of the content is taken from open-source websites & some are copyright free for the purpose of disseminating knowledge. Those some we/I had mentioned above in the references section and acknowledged/cited as when and where required. The author/s have cited their joint own work mostly, and tables/data from other referenced sources in this particular paper with the narrative & endorsement have been presented within quotes and reference at the bottom of the article accordingly & appropriately. Finally, some of the contents are taken or overlapped from open-source websites for knowledge purposes. Those some of i/we had mentioned above in the references section. On the other hand, opinions expressed in this paper are those of the author and do not reflect the views of the GJEIS. The authors have made every effort to ensure that the information in this paper is correct, any remaining errors and deficiencies are solely their responsibility.



A. Chandramohan,  
 Ramya Thiyagarajan and P. Srinivas Kumar  
 "Quality Assurance Management Design Approach  
 for Construction Project Management Special  
 reference to Soil Testing works"  
 Volume-16, Issue-3, Jul-Sept 2024. (www.gjeis.com)

<https://doi.org/10.18311/gjeis/2024>  
 Volume-16, Issue-3, Jul-Sept 2024

Online iSSN : 0975-1432, Print iSSN : 0975-153X  
 Frequency : Quarterly, Published Since : 2009

Google Citations: Since 2009

H-Index = 96

i10-Index: 964

Source: <https://scholar.google.co.in/citations?user=S47TtNkAAAAJ&hl=en>



**Conflict of Interest:** Author of a Paper had no conflict neither financially nor academically.