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Necessity of Quality Checklist for Performance Improvement in Road Project

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Abstract – The main focus of the construction industry is to ensure that projects are successfully completed within the constraints of best quality, stated period and at minimum cost possible. The implementation of Quality Control System in Construction Industry is meant to assist the industry to improve the efficiency and effectiveness of the organization management system in ensuring successful objectives of company. In the area of globalization where economic competition is intensifying, the implementation of Quality Control System will improve the overall construction process and subsequently lead to the formulization of successful business strategies to meet international requirements. But the main problem with quality control system implementation in construction industry is that the check parameter is not easy to understand for employees. The quality parameters should easy to understand specially checklists should be easy to understand and easy for implementation In this study is carried out to analyze the scenario of QC (Quality Control) System application, to identify factors affecting the construction organization and to issue recommendations on how to improve the implementation of QC System in Construction Industry. Initially the checklists are observed from different site the defects will identify in check lists and suggest new checklists for each items of construction. By taking suitable case study modify checklists are implemented and observe the difference in quality in terms of time and money.

Keywords – Construction Industry, Quality Control System, Checklist

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1) INTRODUCTION

QUALITY

Quality is much more complicated term than it appears. It seems that every quality experts defines quality is a somewhat different way.

A modern definition of quality derives from Juran's says that quality is meeting or exceeding customer expectation.

There are five aspects of quality in a business context:

1. Producing – providing something.
2. Checking – confirming that something has been done correctly.
3. Quality Control – controlling a process to ensure that the outcomes are predictable.
4. Quality Management – directing an organization so that it optimizes its performance through analysis and improvement.
5. Quality Assurance – obtaining confidence that a product or service will be satisfactory.

2) QUALITY CONTROL

A process through which a business seeks to ensure that product quality is maintained or improved and manufacturing errors are reduced or eliminated. Quality control requires the business to create an environment in which both management and employees strive for perfection. This is done by training personnel, creating bench marks for product quality and testing products to check for statically significant variation.

A major aspect of quality control is the establishment of well defined controls. These controls help standardize both production and reaction to quality issues. Limiting room of error by specifying which production activation are to be completed by which personnel reduces the chance that employees will be involved in tasks for which they do not have adequate training.

As the market economy has developed, market competition has had an important role of the law of survival of the fittest in every corner. The pressure of construction enterprises from the market and

competitors will be greater and greater, as well as the increasing requirements of customers of quality assurance, which require the construction companies to improve their internal quality, strengthen management, in particular, pay close attention to quality control.

Quality is the symbol of human civilization, and with the progress of human civilization, quality control will play an incomparable role in the business. It can be said that if there is no quality control, there is no economic benefit. Construction projects are an extremely complex process, involving a wide range. There are plenty of factors affecting the quality of construction, such as design, materials, machinery, topography, geology, hydrology, measures, management systems, and so on. Because of the fixed project location, large volume and different location of different projects, the poor control of these factors may produce quality problems. During controlling the whole process of construction, only accord with the required quality standards and user promising requirements, fulfilling quality, time, cost, etc., construction companies could get the best economic effects. Construction companies must adhere to the principle of quality first, and insist on quality standards, with the core of artificial control and prevention, to provide more high quality, safe, suitable, and economic composite product.

3) REASONS WHY QC IMPLEMENTATION IN CONSTRUCTION INDUSTRY

Followings are the defects which would be caused at the time of construction:

- The cement sand mix in the mortar and brick masonry is made quite early, prior to its use and in larger quantities than required.
- The construction materials like sand, bricks, Aggregate etc are not washed and are full of deleterious material and dust.
- Compaction of bottom strata in foundation work is not carried out.
- During concreting of footing, the concrete is poured at a height greater than 1m.
- Generally, trapezoidal footings are resorted to where concrete is never vibrated.
- Reinforced concrete column, being an important part of the structure are neither mechanically vibrated nor machine mixed.
- They are cast in short lifts with increased number of joints.
- Cover to reinforcement in column, beams and slabs is insufficient.
- No cover to reinforcement in contact of the ground
- Misalignment of column at foundation level and rectification at higher level, leading to eccentric loading.
- Reinforced coping at plinth level being an important barrier to dampness is never densely cast.
- The plinth filling is never carried out in layers nor compacted.
- At the joints of Reinforced concrete and brick masonry, either:-

(1) The RC surface is not roughed

(2) Filling of mortar at the joint is not evident.

- The joint of brick masonry at larger height are improperly racked.
- Mixing ratio in plaster and brick masonry is not maintained.
- In the case where beams are cast prior to slabs :

(1) In large slabs, the concrete in beams starts setting before casting of RC slab.

(2) The concrete spilled on the sides of beams while casting is never removed which gets set subsequently.

Results of the followings mistakes:

- Cracks in concrete.
- Improper bonding between concrete and brick masonry.
- Spillage of plaster.
- Dampness of walls.
- Leakage of slabs.
- Cracks in brick masonry.

This is the various mistakes and there results which would be minimized by implementing quality control in construction industry. That's why QC is implemented in construction industry.

Importance of checklist in construction

- Checklists can keep people organized and on task. They provide guidelines that those performing the inspection can follow.
- Employees will feel accountable for performing the inspection because there is a written record.
- Employees will feel more confident in machinery and safety procedures knowing these things are inspected regularly.
- Problems will get caught before accidents happen.
- If OSHA or another outside person/agency inspects the work site, you will have clear documentation about the inspections your site has performed. For example, if a vehicle in your facility malfunctions but you have documentation showing it was recently inspected, you can demonstrate you followed proper safety procedures.
- While paper checklists are common, electronic versions of checklists are available or can be created at your workplace. This way, users can quickly input data using a tablet, laptop or smartphone, and this information will be easily accessible for reporting in the future.

4) LITERATURE REVIEW

Ahmed S. Agha, (2003),This paper concluded that how construction professionals implement TQM and its tools in their projects in the different stages (design and construction). From the results and conclusion from each case study included in this paper, its clearly now that TQM is not a fad and how much benefits that TQM can bring to your construction business.

Ammar AI-Saket, (2003), This paper states that quality control starts with identifying customer needs and ends only when customer is fully satisfied and is concerned with all activities throughout the organization.

Anne Landin, (2001), This paper states that a management control system such as a quality system is not static , but must be altered and remoulded continuously based on changes that occur in the situation in which the company finds itself.

J. A. Akinola1, (2001 This paper states that most of the firms are aware of the benefits of total quality management and the factors enhancing its implementation, however the level of adopting the total quality management principles are very low in Nigeria. The analysis further showed that there is no prevalence of total quality management principle among indigenous construction firms in Nigeria while there is a high

5) OBJECTIVES

Following Are the Objectives of Project

1) To study the need of quality control system and different aspects of quality control system in construction industry.

2) To observe the different checklist from site identify the defects in that checklists.

3) Prepare new checklist for each construction activity.

4) Implemented the new checklists and observe the difference in quality in terms of time and money.

6) METHODOLOGY OUTLINE

For this project, the following flow of work followed –

Step 1- To study the need of quality control system and different aspects of quality control system in construction industry by literature review.

Step 2- By site visits to building construction sites observe the different checklist from site identify the defects in that checklists

Step 3: Prepare new checklist for each construction activity.

Step 4- By taking the suitable case study Implantation of the new checklists and observe the difference in quality in terms of time and money.

7) DATA COLLECTION AND ANALYSIS

Introduction: The current checklist used for quality control on site are observed from different sites adjoining the Wagholi area the defects are found in that checklist by removing that defects the new checklist are prepared for each item of construction.

The details of Site as follows

1) Pragati Group pf Companies Pune

2) Nyati Group Pune

3) Raj Builcon

4) Kulswamni Construction Wagholi

5) Venkatesh Byuilders Lohagaon

6) Sukhakarta Associates

EXCAVATION

Excavation is regarded as one of the most hazardous construction operations. Excavation failure occurs very quickly, giving a worker virtually no time to escape, especially if the collapse is extensive and the excavation is a trench. Normally, a slab of earth collapses off the trench face under its own weight and breaks against the opposite wall of the excavation, burying and crushing any person in its path. This can result in death by suffocation or internal injuries.The safe practices required in carrying out all forms of excavations, including trenching, in various soil types. Advice is given on the provision of protective systems to prevent cave-ins, and to protect employees when cave-ins occur, and to protect employees from material that could fall or roll from an excavated face or from the collapse of adjacent structures.Protective systems include support systems (steel, aluminium and timber), battering, benching, and shield systems.

DEFINATION

The terms 'excavation', 'excavation work' and 'competent person' are used extensively in this code of practice.

- 'excavation' means a hole in the earth, or a face of earth, formed after rock, sand, soil or other material is removed (such as a trench, ditch, shaft, well, tunnel, pier hole, cutting or caisson or a hole drilled in the earth).

- 'Excavation work' means work to make, fill or partly fill an excavation.

DEFETS

Following are the defects at the time of excavation:

1) The fall or dislodgement of earth or rock.

2) The instability of any adjoining structure caused by the excavation.

3) Any previous disturbance of the ground including previous excavation.

4) The instability of the excavation due to persons or plant working adjacent to the excavation.

5) The presence of or possible inrush of water or other liquid

6) Vibration and hazardous noise.

REMEDIES

Following are the remedies for above defects:

1) Excavation shall be kept to the minimum. The limits of the excavation shall not extend more than 1.0 meter beyond the footprint of the footings.

2) Under winter conditions, the Contractor shall remove frost from the base of the excavation.

Excavations shall be dewatered and maintained dewatered so that the material is excavated in its natural state and construction of the foundations is completed in the dry.

CHECK LIST:

ACTIVITY- EXCAVATION				
SR NO	**TO BE CHECKED**	**YES**	**NO**	**REMARK**
PRE-EXECUTION CHECKS				
1	Are the latest "good for construction" drawing available?			
2	Is the soil investigation report kept on-site?			
3	Have TBMs been established?			
4	Storage or intermediary storage identified for superficial mass of earth excavated?			
5	Are access routes available?			
6	Are tress present?			
7	Is a possible to display larger excavation machinery?			
8	Is a ramp for vehicular movement required?			
9	Has a grid line marking been done at the neighboring construction activities?			
10	Is a first aid kit available on site?			
11	Are all the requirement met for maintaining dewatering?			

12	Is it possible to employ water pumps?			
13	Does the depth excavated include the depth of the construction of work?			
14	Has the consultant inspected the site before commencement of work?			
15	Are the required tools available?			
CHECKES DURING EXECUTION				
16	Has the block level register been maintained?			
17	Are the layout and alignment as per drawing?			
18	Has the required depth of cut been achieved?			
19	If the excavation is beyond 1.25m are there steps provided?			
20	Has proper shoring and shuttering been done in loose soils?			
21	Is the excavation barricaded at a distance of 1m?			

PLINTH FILLING

Plinth filling shall be carried out with approved material in layers not exceeding 45 cm, watered and compacted with mechanical compaction machines. Engineer may however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level, the surface shall be flooded with water, unless otherwise directed, for at least 24 hours, allowed to dry and then the surface again compacted as specified above to avoid settlements at a later stage. The finished level of the filling shall be trimmed to the level/slope specified.Where specified in the schedule of works, compaction of the plinth fill shall be carried out by means of 12 tones rollers smooth wheeled, sheep-foot or wobbly wheeled rollers. A smaller weight roller may be used only if permitted by Engineer. As rolling proceeds water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill.

The thickness of each unconsolidated fill layer can in this case be up to a maximum of 450 mm. Engineer will determine the thickness of the layers in which fill has to be consolidated depending on the fill materials and equipment used. Rolling shall commence from the outer edge and progress towards the centre and continue until compaction is to the satisfaction of Engineer, but in no case less than 10 passes of the roller will be accepted for each layer.The compacted surface shall be properly shaped, trimmed and consolidated to an even and uniform gradient. All soft spots shall be excavated and filled and consolidated.

DEFETS

Following are the defects occurs at the time of plinth filling:

1. At the time of filling air voids may produce.

2. Uneven settlement may occurs

REMEDIES

Following are the remedies over the above defects:

1. **Earth Filling :** The earth, soft murrum etc. so brought shall be filled up in layers of 15 cm depth, each layer being well watered and consolidated by approved hand or mechanical tampers or other suitable means to achieve the required density.

2. **Gravel or Sand Filling:** Gravel if required to be filled under floors, shall be single washed gravel of approved quality and of size varying from 12 mm. to 20 mm. it shall be uniformly blinded with approved type of soil and/or sand to obtain full compaction. Gravel shall be filled in specified thickness and shall be well watered and rammed entirely to the satisfaction of the Engineer-in-Charge.

3. If sand is required to be filled under floors, it shall be clean, medium grained and free from impurities. The filled in sand shall be kept flooded with water for 24 hrs. to ensure maximum consolidation. Any temporary work required to maintain sand under flooded condition shall be done by the contractor at his own cost. The surface shall then be well dressed and got approved from Engineer-in-Charge before any other work is taken over the fill.

CHECK LIST:

ACTIVITY- PLINTH FILLING				
SR NO	**TO BE CHECKED**	**YES**	**NO**	**REMARK**
PRE-EXECUTION CHECKS				

1	Are the latest "good for construction" drawing available?			
2	Is the soil investigation report kept on site?			
3	Are safety measures required for the neighbouring construction activities?			
4	Are all the requirement met for maintaining dewatering?			
5	Is it possible to employ water pupms?			
6	Does the depth of compaction account for soling?			
7	Are the required tools available?			
CHECKS DURING EXECUTION				
8	Is the compacting of the backfilled earth done by the appropriate method?			
9	Does the backfilling material meet the acceptable soil characteristic?			

SOLING

Hard core soling can be done either by bricks or by rubble stones laid under floors/foundation, hand packed or as per specification or requirement at site.

The rubble soling generally used are of best verity of black trap/granite/basalt or other verity of stone available locally. The stone should be hard, durable free from defect and of required size as required at site or as per specification.

The bed on which rubble soling is to be laid should be cleared of all loose material, leveled, watered and compacted before laying rubble soling. Cable or pipe trenches if required shall be got done before the soling is started.

Over the prepared surface, the stone should be set as closely as possible and will packed and firmly set. The stone should be full height and should be laid as to have their bases of the largest area resting on sub grade. Soling should be laid in one layer of 230mm or 150mm depth or specified thickness of soling with a tolerance of 25mm. After packing the stones properly in position, the interstices between them should be carefully filled with quarry spoils or stone chips of large size possible to obtain a bard, compact surface. Spreading of loose spoils or stone chips knocked off by a hammer and all interstices should be fill with approved murrum. Excess murrum if over the surface should be cleared.

DEFETS

Following are the defects occur at the time of soling:

1. Due to poor workmanship surface level may not be properly leveled.

2. Uneven settlement occurs due to overloading at one place.

REMEDIES

Following are the remedies over the above defects:

1. ***Rubble stone soling:*** The rubble stone shall be of best variety of black trap/granite/basalt or other approved variety of stone available locally. The stone shall be hard, durable, free from defects and of required size and shall be approved by the Engineer-in-Charge before incorporation in the work.

2. ***Preparation of Surface*** **:** The bed on which rubble soling is to be laid shall be cleared of all loose materials, levelled, watered and compacted and got approved by the Engineer-in-Charge before laying rubble soling. Cable or pipe trenches if shown in the drawing and as required by the Engineer-in-Charge shall be got done before the soling is started.

3. ***Workmanship*** **:** Over the prepared surface, the stone shall be set as closely as possible and well packed and firmly set. The stones shall be of full height and shall be laid so as to have their bases of the largest area resting on the sub-grade. Soling shall be laid in one layer of 230 mm. or 150 mm. or other specified thickness and no stones shall be less than 230 mm. or 150 mm.

depth or specified thickness of soling with a tolerance of 25mm.

4. After packing the stones properly in position, the interstices between them shall be carefully filled with quarry spoils or stone chips of larger size possible, to obtain a hard, compact surface. Spreading of loose spoils or stone chips is prohibited.

CHECK LIST:

ACTIVITY- SOLING				
SR NO	**TO BE CHECKED**	**YES**	**NO**	**REMARK**
1	Name, date and number of the drawing			
PRE-EXCUTION CHECKS				
2	Are the latest "good for construction" drawing available?			
3	Are safety measures required for the neighboring construction activities?			
4	Has the filled material been compacted and rammed?			
5	Are the required tools available?			
CHECK DURING EXECUTION				
6	Is the aggregate of proper grading being used?			
7	Does the soling aggregate used match the load be carried?			
8	Has the point of height indicator been installed and if so, is the depth of soling adequate?			
9	Are the voids between the soling stones being filled With quarry dust?			
10	Has the level of soling being maintained ?			

8) CONCLUSION

The construction industry suffers from several problems such as low productivity, poor health and safety and inadequate quality. Quality control can be a solution to these problems. This study investigated the necessity and benefits to the extensive implementation of quality control in the construction industry through a questionnaire survey. From the results and conclusions from case study, it's clearly indicate that quality control system in the construction industry is not a fad and how much benefits that quality control system can bring to your construction business (improve business quality, increase customer satisfaction, reduce cost, save time, and much more).

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