QUALITY MANAGEMENT & QUALITY ASSURANCE

By

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1. Introduction

In today's talk we will briefly look at the historical progression of quality management system from primitive craftsman to ISO 9000 family of Standards. The primitive craftsman made his products attractive for his customers ensuring that his products were meeting requirements of the customers. There were two strong incentives for him to produce quality products viz.

- his personal pride in his product and craftsmanship, and
- dependability of his livelihood on the product.

He made continuous efforts to ascertain requirements of his customers; he selected proper materials, a suitable design and sequence of production and finishing. He took pride in maintaining a reputation of excellence. He even trained his off-springs in the skills adopted by him so that they could maintain his tradition. *But he kept his skills secret from his competitors.*

We see the historical infrastructure works built centuries ago are still in service. The Mughal buildings, tombs, forts; the British period rail road bridges, tunnels, irrigation head works are a few examples. This shows that sense of Quality was always there.

Let us look at the Oxford Dictionary meaning of 'Quality' —

- the degree of excellence of a thing,
- general excellence — *their work has quality.*

What a tribute! If a Client has this opinion about your Company you are justified in taking pride in your work, the work of your colleagues and the prestige of your Company.

2. Perception of Quality

Let us see what is the perception of Quality for the human mind:

- we appreciate the clean and courteous service of a restaurant;
- we admire the luxury and exceptional performance of Rolls Royce;
- we put faith in toughness and dependability of a Range Rover and a Land Cruiser; but these are a few examples of what we perceive as Quality.

3. Advent of Factory Culture

The first industrial revolution created the modern organized factory system. This approach led to the reduction of craftsmanship to a series of simple processes /procedures that could be carried out by any one with the minimum of skills. Those were the times when mass influx of poor illiterate people migrated to USA. They were grateful for employment in factories. The widespread adoption of modern factory culture by the giant automobile manufacturers brought unprecedented prosperity to those societies.

4. Inspection & Sampling

The factory system abolished the basic element of craftsmanship that was responsible for quality, and replaced it with inspection and checking system. In 1920 the industry began to apply statistical methods to control quality and developing methods of random sampling, so that batches of products could be accepted or rejected.

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The inspection system showed its benefits but there were inherent limitations in standard setting and monitoring approach. The system depended on probability and human observation, as such some items which did not conform to specifications were inevitably missed out. In fact the more non-conforming items there were, the more would get through to the end customer.

5. Japanese Initiative

In the late 1940's to 1950's, the Japanese adopted the Western factory system and then rejected it. Devastated by World War-II and notorious in the world as a producer of cheap and poor quality goods, industry leadership in Japan embarked upon the journey to improve the quality of the products of its industry and compete in the international market.

In 1950 the Union of Japanese Scientists and Engineers invited Dr. W.E. Deming, a Quality Guru, to address a high level group of Japanese company presidents. Dr. Deming, during his week long course on quality control, gave them a new approach for achieving Quality.

Among the principles and practices of Quality Management established by Dr. Deming, the approach was based on the following three concepts:

- Quality is the ultimate responsibility of top management;
- Control by inspection is not enough, everyone must accept responsibility for controlling and checking his work; and
- Educate, train and motivate employees to achieve and improve quality throughout the organization.

The Japanese industry achieved tremendous success by adopting this approach.

Release of Allied Quality Assurance Standards by NATO

In the 1960's the UK Ministry of Defense and the US Navy became increasingly concerned about the reliability and performance of the equipment supplied by the contractors. These events led to the release of Allied Quality Assurance Standards in 1968 by NATO. These standards progressively shifted emphasis from inspection to assessment of contractors/vendors capability to meet customers' requirements.

Complementing the NATO standards, the British Standards Institute issued BS 4891 and BS 5179 in 1972 and 1975 respectively. These standards provided guidelines for assessing capabilities of contractors.

Release of BS 5750 and birth of ISO 9000 family of standards

The birth of what is now called ISO 9000 series of standards, took place in 1979 with the release of BS 5750. The BS 5750 series of standards established a concept of quality management system — the organization structure, processes, procedures, resources needed to implement the quality management. The British call it the mother standard. The ISO Standards are dubbed as product of war. British victory in War of Waterloo against France is said to be a victory of Standards.

ISO Technical Committee TC 176

The International Organization for Standardization (ISO) formed a Technical Committee TC 176 in 1979 to create International Standards for Quality Assurance.

The ISO 9000 series of standards were published in 1987, based principally on BS 5750. ISO 9000 series of standards provide guidance on models for development and implementation of a quality system.

Three models were defined for companies engaged in design, development, and production and servicing. These standards are complemented by other standards which give guidance on issues related to ISO 9000 series. There are associated standards, such as ISO 14000 series

which provide guidance on environmental issues. Periodic revisions of ISO 9000 series have been issued, 1st Revision was issued in 1994.

ISO Standards are written in generic terms and can be applied to any manufacturing and / or service establishment. Engineering Organizations, Consultancy Services Companies, all manufacturing Industry, Construction Industry, Pharmaceutical Industry, Hospital Laboratories, Education Organizations, Petroleum Industry, Garments Industry etc.

Generally relevant ISO Standards for Consultancy Services are the latest revisions of:

- ISO 9000 -- Quality Management Systems — Fundamentals and Vocabulary;
- ISO 9001-- Quality Management Systems — Requirements;
- ISO 9004 -- Managing for the sustained success of an organization — A Quality Management Approach;
- ISO 14001 Environmental Management Systems — Requirements;
- International Electrotechnical Commission (IEC) Standards;
- ISO 19011 Guidelines for Auditing Quality Management / Environmental Management Systems.

Organizations aiming to establish a Quality Management System (QMS) can get guidance from ISO 9001: 2008 for preparing requisite documentation. This ISO Standard takes into consideration the Quality Management Principals stated in ISO 9000 and ISO 9004, and is compatible with ISO 14001:2004.

Documentation requirement for establishing a Quality Management System (QMS) for a Company is as follows:

A QMS Manual conforming with eight (8) Sections of ISO 9001:2008 viz —

- Scope
- Normative references
- Terms and definitions
- Quality Management System
- Management responsibility
- Resource management
- Product realization
- Measurement, analysis and improvement

If any of the Sections/Sub-sections are not applicable to the business activities of the Company, those can be stated as Exclusions in the beginning of the QMS Manual.

The extent of a QMS documentation can differ from one company to another company depending upon 1) size of the company and type of activities undertaken, 2) complexity of processes/procedures, and 3) competence of company's personnel.

Some Procedures have to be prepared for activities in the head office of the Company which are e.g:

- Procedure for Control of Correspondence
- Procedure for Control of Quality Records/Documents
- Procedure for Purchase and Issuance of Stores
- Procedure for Business Development
- Procedure for Recruitment/Selection of Personnel
- Procedure for Development & Design
- Procedure for preparation of Reports & Memoranda
- Procedure for Control of Non-Conforming Product/Service

- Procedure for Management Review

When the Company signs a Service Contract with a Client say for a Hydropower Project to provide all involving services as The Engineer; among other documentation and from the standpoint of Quality Management, the following documents will be prepared:

- Project Quality Assurance Plan
- Project Procedures Manual
- Job Descriptions Project Personnel

On award of Construction Contract(s), assuming FIDIC Conditions of Contract, and as the Contractor moves to the Site and starts Mobilizing, he will submit his Quality Management Plan and Method Statement for Engineer's review and comments.

On start of construction activities, the Contractor will start submitting a number of Work Procedures in advance of his work activities for Engineer's review and approval.

The Engineer will also prepare corresponding Work Procedures for his personnel for Monitoring & Inspection of Contractor's work activities.

A tentative list of such Engineer's Work Procedures is shown below:

1. Monitoring and Inspection of Contractor's Work Activities.
2. Inspection, Testing and Approval of Permanent Materials (Flyash — cement, reinforcement steel bars, waterstops, admixtures for concrete, curing compound, etc.) including embedded metals.
3. Monitoring of Incoming permanent Plan and Equipment.
4. Earthwork- Excavation in soil/ Rock, Fill
5. Procedure for Erection and Fixing of Formwork.
6. Procedure for Concrete Works signing off check- out forms.
7. Establishment of Survey Control Network.
8. Line and Grade of Earthworks and Concrete Structure.
9. Record, Storage and Calibration of Survey Equipment.
10. Control of Drawings.
11. Procedure for Computer Backup.
12. Procedure for Placing Steel Reinforcement and Embedded Items.
13. Concrete Expansion, Contraction, Control and Construction Joints.
14. Concrete Surface Finishing.
15. Procedure for Curing and Protection of Concrete
16. Procedure for Repair of Concrete works
17. Procedure for Precast and Post-Tensioned Concrete Elements
18. Measurement of Works amid Interim Payment Certificate
19. Procedure for Variation Orders
20. Project Progress and Scheduling
21. Drilling and Grouting
22. Installation of Geo-Technical Instruments
23. Installation of Gate Equipment
24. Welding Control Procedure
25. Drafting Monthly Progress Report
26. Review and Approval of Contractor's Quality System Documents
27. Procedure for Mapping exposed foundation Geology
28. Procedure for Laboratory Support Services

These procedures generally have Check-out Form(s) as an attachment which are agreed between the Engineer and the Contractor. Sample Check-out Forms for concrete placement are shown.

Project Consultant's Title	Distribution:1) Consultant's Rep. 2) Contractor's Rep.3) Any other Section	Contractor's Title and Contract No.

APPROVAL TO PLACE CONCRETE — **Date:----------**

Location:	Structure:		Segment No.
Drawing No.	Rev.	Type of Mix(s):	Approx. Qty.
Location of Batching Plant:			Source of water:

ACCEPTANCE AT PLACE OF POURING

Description of work	Control Activities	Initials		Description of work	Control Activities	Initials	
		Con-tractor's Rep.	Consultant's Rep.			Con-tractor's Rep.	Consultant's Rep.
Reinforcement	Foundation preparation				Mould oil		
	Survey checks				Access Ladder		
	Conformance to dwgs.				Safety railings		
	Earthing			**Permanent Materials**	Conformance to drwgs.		
	Cover/spacer blocks				Placing & Fixing		
	Joint prepr./Cleanliness			**Equipment**	Batching Plant Calibration		
	Lap Length/Jointing				Concrete mixer availability		
	Fixing				Conc.Pump availability		
	Links/stirrups/chairs				Vibrators suitability/standby		
	Water Stops				Richter/Tower crane		
				Manpower	Placing & Fixing		
Protection & Curing	Materials				Steel Fixer & Carpenter		
	Equipment						
Embedded Parts							
Formwork	Dimension/verticality/Horizontally/Interface						
	Placing						
	Class of Finish						
	Rigidity						
	Water-tightness						
	Cleanliness						

Engineer's Instructions		
Sketch		REMARKS:
Correspondence		

APPROVAL FOR POURING OF CONCRETE

Section Engineer(Contractor) **Shift Engineer(Consultants)**

Form No. 2

Project Consultant's Title	Distribution:1) Consultant's Rep. 2) Contractor's Rep.3) Any other Section	Contractor's Title and Contract No.
CONCRETE DELIVERY NOTE		Date :…….. Sheet….. of ……
Location:	Structure:	Lift No.
Batching Plan……	Truck No……	Concrete Quantity:……m^3
Mix Design No……	Concrete Requirement: Temperature:…… ^0C Slump…… mm	Strength…… MPa
Batch No…….	Requisition No…… Date:……	Truck Departure Time:……

FILLED BY LABORATORY STAFF AT BATCHING PLANT

Departure Time	Air Temp.	Concrete Temp.	Slump mm	Sample Codification	No. of Cylinders Casted	Start of Mixing Time	End of Mixing Time

REMARKS:

Section Engineer (Contractor) Shift

Engineer/Inspector(Consultants)

Form No. 3

Project Consultant's Title	**Distribution:1) Consultant's Rep. 2) Contractor's Rep.3) Any other Section**	**Contractor's Title and Contract No.**

CONCRETE PLACING RECORD	Date:…… Shift…… Sheet….. of……

LOCATION:…… ……..		STRUCTURE: …….

WEATHER …….. AIR TEMP…. ^{0}C	……Batching Plant

Conc. Mix Design:…….	Concrete requirements: Temp:……. ^{o}C Slump: …….. mm Strength: ……. MPa

Hours Started …….. Hours Finished ……. Total Time …… hrs.-

Batch No.	Truck No.	TIME BETWEEN MIXING & PLACING					VOLUME PLACED		SLUMP / TEMP.	**REMARKS (cubes / cylinders cast)**
		Depar. from Plant	Arrival At Site	Start of Placing	End of Placing	Total Time	Batch	Volume m^3		

Shift Engineer/Inspector(Consultants)