

**-Minutes of Meeting**  
**ACI Committee 121**  
**Quality Assurance Systems for Concrete**  
**Sunday, October 21, 2012**  
**3:00 – 5:00 PM**  
**Sheraton Centre**  
**Windsor**  
**Toronto, ON**

1. Call to Order and Welcome  
The Chair, Tom Tyler, called the meeting to order at 3:00
2. Introduction of Members and Guests  
The nine attending members, seven guests, and TAC contact introduced themselves.
3. Update of Membership Status  
Jerry Parnes has applied for membership, Michael Jaycox and Ryan Riehle have resigned from the Committee. Mihaela Birley has been made a voting member
4. Establish Date of next Meeting  
The next meeting will take place on Sunday, October 21, 2012, 3:00 to 5:00 PM in Minneapolis, MN.
5. Attendance  
Attending were the following (Appendix A):

Voting Members:

- |                     |                     |
|---------------------|---------------------|
| 1. Tom Tyler        | 5. Paul Brooks      |
| 2. Jon Ardahl       | 6. Martin Fradua    |
| 3. Michelle Walters | 7. Stephen Marchese |
| 4. Godwin Amekuedi  | 8. Oon-Soo Ooi      |

Associate Members:

1. Mihaela Birley

TAC Contact:

1. Andy Taylor

Guests

- |                        |                      |
|------------------------|----------------------|
| 1. Jeremy Chesterfield | 4. Jerry Parnes      |
| 2. Timothy Frazer      | 5. Kenneth Wasserman |
| 3. Ben Hendriks        |                      |

6. Approval of Minutes from (Previous) Meeting

The Minutes from the Cincinnati meeting were accepted by the Committee with a motion to be approved by Martin Fradua, seconded by Paul Brooks and accepted.

7. Announcements

The Chair attended the work shop for committee Chairs where he was brought up to date on the latest developments in ACI. An account of the information presented is attached (Appendix B)

8. Old business

A. Revisions to the document – 121R-08—“*Guide for Concrete Construction Quality Systems in Conformance with ISO 9001*”

No change since Dallas meeting (See Dallas Minutes).

B. Audit Document – Status

1. Chair Tyler restated the goals and intent of the new audit document and re-circulated the Abstract (Appendix C) and Section Requirements (Appendix D).

2. Task Groups (TG) were developed to hold meetings for the Toronto Convention (See Appendix E) for TG Assignments. The proceedings of the TG Meetings held in Toronto and the TG statuses are summarized below.

a. **Task Group 1 - Overall Document/Common Processes**  
(Tyler/Birley/Turham)

There was no TG Meeting for TG 1. There has been, however, a pretty good start on the overall document as well as the section on Common Process (quality management processes common to all elements of the industry) . The overall document has been structured with a Table of Contents outlining the elements of the industry to be addressed. The Section on Common Processes will be based upon the guidelines, style, and format of ISO 9001-19011 – “*Guidelines for Quality and/or Environmental Management Systems Auditing*”. Subsections within the Common Processes for Training, Supplier and Subcontractor Control, Process Control, and Calibration of Equipment have been drafted. And an audit procedure and standard reporting forms have been provided by Jim Turnham

A copy of the draft was handled out (Appendix F).

- b. **Task Group 2 - Design (Walters/Fradua)**

The task group meeting on Sunday had been attended by Walters, Tyler, Fradua, Parnes, Marchese, and Wasserman. Walters reported that there were 3 documents prepared for consideration with two different styles of presentation. Chair Tyler directed the group to focus on quality assurance with a broad style approach as directed in the Section Requirements rather than try to be too specific at this point.
- c. **Task Group 7 - Lab & Field Testing (Marchese/Ooi)**

The task group meeting on Sunday had been attended by Walters, Tyler, Parnes, Marchese, Oi, and Birley. Marchese reported that the group discussed that the lab audit depends on the auditing body. This group has split up the work to identify the different auditors, and develop audit questions to accommodate all auditor requirements. At this point we have an outline and some text started by Gene Takhtovich. Chair Tyler believes there should be some explanation in this section addressing the various accrediting bodies, how they are layered, how many labs are certified by them, and what their accreditations cover.
- d. **Task Group 9 - Precast (Tyler/Fradua)**

The precast TG met on Tuesday morning. The meeting was attended by Tyler, Fradua, and Mehta. Mehta has provided an audit checklist and procedure that his company has developed for use by Caltrans. The approach will probably be to use this checklist and some others, if other states have them, pick out the high points, and use them in our own discussion and checklist. Whether permission is needed to use a Sate DOT's reference material is necessary or not needs to be investigated.
- e. **Task Group 6 - Batching (Amekuedi)**

The Batching TG Meeting was set for Monday afternoon but was cancelled, because Amekuedi had to leave the convention early.
- f. **Task Group 5 - Materials**

Task Group 5 for Materials was discussed by Brooks. The discussion led to an agreement that material requirements are closely linked to batching requirements. Chair Tyler

agreed that Task Group 5 should be merged with Task Group 6.

g. **Task Group 8 – Construction**



This TG was not discussed at the meeting. As an update, quite a bit of text and audit questions have already been put together. They were handed out at the last convention meeting in Dallas as an attachment.

9. New Business

No new business was discussed at the meeting.

10. Adjourn

The meeting was adjourned at 4:15pm.

Thomas Tyler	
	Chair
Michelle Walters	
	Secretary

Attachments:

- Appendix A – Sign in Sheet
- Appendix B – Notes from Chairs' Breakfast
- Appendix C – Audit Abstract
- Appendix D – Section Requirements
- Appendix E – Task Group Assignments
- Appendix F – Draft of Overall Document – “Guidelines for Auditing in the Concrete Industry”



**American Concrete Institute®**  
Advancing concrete knowledge

## Committee Meeting Sign In Sheet\*

Page: 1

Committee: <u>ACI COMMITTEE 121 - QUALITY.</u>		Date: <u>Oct 21</u>	
Name and Address (Please Print):			
* Members - Please give address, phone number, and e-mail only if changed			
* Visitors - Please give complete address, phone number, and e-mail			
	Comm. Member?	Visitor? **	
MICHAEL WALTERS	X		
STEPHEN MARCHESE	X		
MIHAELA BIRLEY			
Ben Hendriks			X
Paul Brooks	X		
JERRY FARNES			ASSOC. X
Don-Soo Doi	X		
THOMAS TYLER	X		
Kenneth Wasserman			X
Jeremy Chesterfield - McLoig Materials <small>jchesterfield@mcloig.biz 12100 Wayne Rd. Romulus, MI</small>			✓
Timothy Farrina <small>Commander Allen</small>			✓
OWEN Q. AMERLING I	✓		
MARTIN FRADUA	✓		
Jon B. Arnold	✓		
Andy Taylor (TAC contact)			✓

\***Technical Committee Attendees:** The purpose of an ACI technical committee is to reach consensus and publish information on concrete-related issues within its mission. The discussions at the committee's meetings are part of this consensus process, and are not the official position of a committee. Only a published committee document represents the formal consensus of the committee and the Institute.

\*\* Visitors interested in committee membership should contact the chair or visit the ACI website, [www.concrete.org](http://www.concrete.org), for a membership application.

Return this Form to the Committee Chair or Secretary

## Notes from Chairs Breakfast – Toronto, Canada

Toronto, Canada

October 22, 2012

1. David Lange – TAC Chairman
  - a. There are now two new committees, ACI 377 – Performance-Based Structural Integrity & Resilience of Concrete Structures, which has been approved, and ACI 564, which has not yet been approved. Also, in development is a new task group for Natural Disaster Reconnaissance.
  - b. ACI 562 – *Evaluation, Repair, and Rehabilitation of Concrete Buildings* is now a provisional code and has been submitted to the International Existing Building Council (IEBC) for approval.
  - c. **Concrete Terminology** is now a standard. It will be posted on the web site starting in December of 2012. It must be referred to in the writing of new documents.
  - d. Recently approved new documents have been accomplished by Committees 211, 238, 423, and 506.
  - e. The Webinar **Committee Ballots for Documents** is now a video and is available on line on the ACI Website under Technical/Document Development/Document Balloting.
  
2. Joseph Sanders, Chair, Concrete Research Council

Mr. Sanders gave an update on the CRC activities. A Research Workshop was held in the spring of 2100 and was attended by owners, funders and researchers. A Strategic Planning Session was held in the Fall of 2011 with cooperative efforts from CRSI, PCA, PCI and the Concrete Contractors Association. It included a definition of needs, reviews of proposals, and discussions regarding funding.
  
3. Randy Poston, Chair, Committee 318

Mr. Poston gave a rundown on the new ACI 318-14 to be submitted to TAC for final approval in the Fall of 2013.

  - a. The Code will be organized by structural member.
  - b. It will be organized into six (6) blocks as follows:
    1. Administrative (notation, reference standards, etc.)
    2. Design Tool box
    3. Members based design sections
    4. Earthquake resistance Design
    5. Reinforcing materials and detail toolbox
    6. Material QA/QCD, construction requirements, strength evaluation.
  - c. There is a portal on the Website Homepage for the new 318. Click the *Designer* Tab on the Home Page and it will take you to this portal.
  - d. It needs to be kept in mind that the focus of TAC will be on the review and acceptance of the new 318 and all other documents submitted for approval during that time will be queued up until that effort is complete.

4. James Wright, President, ACI  
Mr. Wright spoke of his international technical exchange activities with the Concrete Society of London, the International Federation for Concrete (fib), the Japan Concrete Institute (JCI), and Korea Concrete Institute (KCI) who will be hosting a session in Toronto.
  
5. Lawrence Kahn, Professor, Georgia Tech  
Mr. Kahn spoke about the new ACI 562 – Evaluation, Repair, and Rehabilitation of Concrete Buildings.
  - a. The new code employs about 50% of the information in the ACI 318
  - b. It is a performance based code, non prescriptive, thereby providing enough flexibility to allow for creativity.
  - c. It focuses on sustainability
  - d. It defines the responsibility of licensed design professional
  - e. Other committees have been asked for used as references within the code. They include 214, 228, 318, 364, 437, 440, and 546.
  - f. It will be adopted by the IEBC by 2015.

## *Abstract* *Guide to Audits in the Concrete Industry*

Develop a guide to auditing for use in the concrete industry. It should be based on ISO 9001-2008 principles and address all processes (elements) with the industry. It has to be presented in non-mandatory language unless quoting directly from a document that uses mandatory language.

It is to start with a section on conducting audits to address:

1. Objectives of audits
2. Planning audits
3. Protocol and etiquette to include rules of engagement
4. Tools (such as reports of “findings” and corrective action requests)
5. Follow up Procedures

The Guide will continue with a section on each of the major processes that make up the elements of the concrete construction industry. These sections are to be prefaced with an introduction that gives:

1. A brief description of the nature of that process
2. Its industry history
3. The manner in which it is integrated into the other processes
4. Scope and objectives
5. Insight regarding typical quality issues one might find within that process.

Following this, the sections will be populated with general questions, specific to that industry process and meant to initiate further discussion as to how the auditee conducts business and / or how the auditee addresses specific requirements if they apply.

T. Tyler  
03/04/12



## Section Requirements

03/18/12

Introductory Subsection should contain the following:

- Scope of Section  
Set limits of section and make reference to other sections covering sub processes related to this section. *Example:* The Precasting section should refer to the batching and delivery section (rather than repeating the same information).
- History of Process / Role in the Industry  
This will require some research but will put a historical perspective on the process and how it evolved into its present role in the industry. *Example:* The rise of precast after WWII, what the best applications are for it, and how it usually takes the role of a supplier only.
- Industry References.  
This would include the codes employed, the organizations that steer that part of the industry, guide publications, certification programs for both organizations and individuals, and the how the various levels of the certifications apply. *Example:* The role of the PCI and its various plant and inspector certification programs.
- Major issues  
A description of the topics to keep an eye on in the course of the audit along with the reasons why. *Example:* Steam curing methods for the precast industry.

### Audit Questions

The questions on the Audit Checklist are intended to keep the audit on track and hit all the issues, leaving nothing behind. They are meant to highlight the topics to be covered and open the door to start the conversation.

The questions should be top tier questions. They need to be leading and generalized to prompt an answer that will lead to other questions. Rather than ask “Do you follow section XXX of the PCI manual for your steam curing?” one would ask “How do you steam cure?” From there the auditor can drill down for more information depending on the type of answer received. Let the auditee do the explaining and the auditor evaluates the response. The Auditor’s background in the process is to be provided by the introduction and his own research into project specific requirements (specs, plans, submittals, and industry standards.)

# Appendix E

## Task Group Assignments and Members

### TG 1 – Common Processes

Birley, Turnham, Tyler, Walters

### TG 2 – Design

Fradua, Hedli, Parnes, Walters, Schor

### TG 3 – Detailing and Reinforcing

Birley

### TG 4 – Mix Design and Development

Takhtovich, Marchese, Ooi

### TG 5 – Manufacture of Materials

Brooks, Greene

### TG 6 - Batching and Delivery

Amekuedi, Brooks

### TG 7 – Lab and Field Testing

Marchese, Ooi, Takhtovich

### TG 8 – Construction

Osburn, Tyler, Vogt

### TG 9 – Precasting

Mehta, Fradua, Tyler

### TG 10 – Post Tensioning

### TG 11 – Statistics

Walters, Allyn Luke

### TG 12 – Shotcrete

### **Guidelines for auditing in the concrete industry**

*REV 2 – October 18, 2012*

**Based on - or to be read in conjunction with:**

**“ACI 121R-08 Guide for Concrete Construction Quality Systems  
in Conformance with ISO 9001”**

**Reported by ACI Committee 121 -**

First edition

**Draft dated: 2012-10-18**

[Notes: Use of square brackets [...] is to identify internal instruction for the writers, which in later revisions the information in square brackets will be removed.]

#### **Document Status:**

2012-10-14:

- Jim Turnham did minor revision to make the outline presentable and to show current status prior to the Toronto ACI Convention.
- Previous track changes that had been reviewed were accepted and removed. Some new revisions to portions have track changes so that the committee may review and accept (or reject prior to the convention).
- Additional revisions or edits were made to sections 1 Scope, section 2 References, and section 3 Terms and Definitions, this time without track changes to prepare for the Toronto ACI convention. Grey font removed in the completed sections and ready for review.
- Tom has added Jim's six (6) QMP Forms in Chapter 8. They include: QMP-010 Audit Procedure, QMP-010AAudit Agenda Form , etc
- Tom has added to this by incorporating Mihaela's text (Chapters 4, 5, and 6) and Tom's subchapters 10.7, 10.9, 10.10, and 10.11.

[this page left in as per the ACI 121 2008 document practice – copying their format]

## **Guidelines for auditing in the concrete industry**

**Based on - or to be read in conjunction with:**

**“ACI 121R-08 Guide for Concrete Construction Quality Systems  
in Conformance with ISO 9001”**

**Reported by ACI Committee 121 -**

**Thomas Tyler – Chair**

**Sub-committee members who prepared this report:**

**Thomas Tyler  
Jim Turnham  
Mihaela Birley**

Foreword .....	iv
Introduction.....	v
1 <b>Scope</b> [Draft Rev A ready for subcommittee review]	
2 <b>References</b> [Draft Rev A ready for subcommittee review]	
3 <b>Terms and definitions</b> [Draft Rev A ready for subcommittee review]	
4 <b>Principles of auditing</b> [Mihaela]	
5 <b>Purpose of External Audits – Compliance</b> [Mihaela]	
6 <b>Purpose of Internal Audits – Compliance and Improvement</b> [This item in particular be given its place to describe how the improvement process can be planned into audits.] [Mihaela]	
<u>7     <b>Managing an audit programme.</b></u> [Mihaela]	
7.1 <b>Creating an Environment for Successful Audits</b>	
7.1.1 <b>Gaining management’s support for the audit process</b> . . . . .	
7.1.2 <b>Gaining employees’ support for the audit process</b> . . . . .	
7.1.3 <b>After the audit</b> . . . . .	
7.2 <b>External and Internal Audit objectives and extent</b> ....[contains the elements of improvement]	
7.3 <b>External and Internal Audit responsibilities, resources, and procedures</b>	
7.4 <b>External and Internal Audit implementation</b>	
7.5 <b>Audit records</b>	
7.6 <b>Audit monitoring and reviewing</b>	
<u>8     <b>Audit activities</b></u> [Mihaela]	
8.1 <b>General</b>	
8.2 <b>Initiating the audit</b>	
8.3 <b>Conducting document review</b> [also contains the element of new vendor assessment]	
8.4 <b>Preparing for the on-site audit activities</b>	
8.5 <b>Conducting on-site audit activities</b>	
8.6 <b>Preparing, approving and distributing the audit report</b>	
8.6.1 <b>Preparing the audit report</b> [including NCRs and corrective actions]	
8.6.2 <b>Approving and distributing the audit report</b>	
8.7 <b>Completing the audit</b>	
8.8 <b>Conducting audit follow-up</b>	
<u>9     <b>Competence and evaluation of auditors</b></u> [Mihaela]	
9.1 <b>General</b>	
9.2 <b>Personal attributes</b>	
9.3 <b>Knowledge and skills</b>	
9.4 <b>Education, work experience, auditor training and audit experience</b>	
9.5 <b>Maintenance and improvement of competence</b>	
9.6 <b>Auditor evaluation</b>	
[The following could be called appendices, or could remain as main chapters – our choice]	
[The content of the following is thought to be Audit Checklists relevant to those subjects]	
<u>10    <b>Audit Checklist Templates – Common Processes</b></u>	
10.1 <b>Audit of Quality Management System Processes</b> [text description of the system audit]	

- 10.2 Management commitment
- 10.3 Document control
- 10.4 Record Control
- 10.5 Communication
- 10.6 Management review
- 10.7 Training [Tom]
- 10.8 Contract management (with owner) (including change control) [Tom]
- 10.9 Supplier and subcontractor management (including purchasing and change control) [Tom]
- 10.10 Process Control (Work Methods) (Procedures) [Tom]
- 10.11 Calibration [Tom]
- 10.12 Internal and External Audits (to see that the auditee is conducting audits)
- 10.13 Control of Nonconformance and Corrective Action
- 10.14 Control of deficiencies
- 10.15 Statistical Analysis - trending
- 10.16 Continuous Improvement [tracking, pre-work improvement plans],
- 10.17 Preventive Action (Risk Management) [preconstruction and Work Method review meetings]

## **11 Audit Checklist Templates – Concrete Construction Processes**

- 11.1 Design
- 11.2 Detailing of Reinforcing
- 11.3 Mix Design and Development
- 11.4 Manufacture of Materials
  - 11.4.1 Cement
  - 11.4.2 Aggregate
  - 11.4.3 Admixtures
  - 11.4.4 Reinforcing
- 11.5 Batching and Delivery
- 11.6 Lab Testing and Field Testing
- 11.7 Construction
  - 11.7.1 General including preparation
  - 11.7.2 Mixes
  - 11.7.3 Formwork
  - 11.7.4 Placement of Reinforcing
  - 11.7.5 Acceptance Testing
  - 11.7.6 Concrete Placement
  - 11.7.7 Curing
  - 11.7.8 Record Keeping ???
- 11.8 Precasting
- 11.9 Post tensioning

## **12 Bibliography**

### **Attachments**

1. QMP-010 Audit Procedure
2. QMP-010A Audit Agenda Form
3. QMP-010B Audit Checklist
4. QMP-010C Audit Schedule
5. QMP-010D Audit Report Form
6. QMP-010E Audit Log – Audits & NCR's

## **Foreword [Upon completion, review this and compare to Tom's previous original info]**

In 2008, ACI committee 121 published a previous document "ACI 121R-08 Guide for Concrete Construction Quality Systems in Conformance with ISO 9001" in order to assist concrete construction organizations to write a Quality Management System (QMS) for their internal use. This new document (ACI 121R-12) should be thought of as a guideline for writing specialized procedures for internal and external auditing that should reside under or along side the above noted QMS.

The Auditing process can be thought of as the foundation of quality management system (QMS) implementation. Auditing is a key ingredient of both compliance with standards, codes, contracts, and also for improvement of processes, systems, projects, and companies. As such, the audit process deserves guidelines (this document) and/or procedures (templates currently supplied as attachments to be edited by and for each organization based on this or similar guidelines) so that compliance and improvement can flourish. This document provides guidelines for auditing – tailored specifically for the concrete construction industry.

ISO (International Organization for Standardization) 19011 is a worldwide standard for quality auditing. This document (ACI 121R-12) contains many auditing elements modelled on the work of ISO 19011 – and permission for use of that document architecture is herein gratefully acknowledged. [We have decided to paraphrase the ISO and ASQ documents and avoid permission requirement.]

ASQ (American Society for Quality) has published a document entitled – "ISO 9001:2008 Internal Audits Made Easy - Tools, Techniques, and Step-By-Step Guidelines for Successful Internal Audits". Key concepts on internal auditing for improvement are gratefully acknowledged from that source. [We decided to paraphrase the ISO and ASQ documents and therefore to not require permission.]

The main task of ACI 121 technical committee is to prepare documents fulfilling the mandate of quality assurance and quality control. Draft documents accepted by the technical committee are circulated to the committee 121 members for voting. Publication of an ACI document requires approval by at least xx % of the members casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of copy-write. ACI has taken measures to acknowledge the origin of materials from outside sources, and has requested permission where needed to utilize materials from outside sources. Clearly, we shall not be inventing or reinventing the audit process, but rather, refining it to best fit the needs of concrete and construction practitioners.

## **Introduction [when we finish, review this and compare to Tom's previous info]**

**ACI Committee 121 role:** The concrete construction industry has long benefitted from the efforts of ACI in providing guidance on control of multitude of properties and constituents of reinforced concrete. ACI committee 121 has been tasked with documentation regarding quality management processes within the concrete construction industry.

**From Resident Engineer to Quality Management System:** Historically – the resident engineer (an agent of the designer) was the source of quality assurance on infrastructure and concrete construction projects. More recently, Owners have discovered and embraced the Design-Build model for construction procurement and with that model, the engineer and designer now work for the contractor and are perceived to have a conflict of interest with regards to quality. Owners have adopted ISO 9001 quality management in order to address quality from a systems point of view within each of the contracting parties including the contractors and designers. This quality management in construction model is fairly wide-spread these days and we would hazard a guess that the majority of concrete construction companies now have quality management systems.

**Writing your QMS with ACI 121R-08 Guide for Concrete Construction Quality Systems in Conformance with ISO 9001:** ISO 9001 requires that each party provide a Quality Management System (QMS) that identifies the commitment to quality for various aspects of the organization. This requirement for companies to have a QMS is addressed in the ACI 121R-08 document and the reader is referred to that resource.

**Quality audit for conformance, improvement, and accountability:** The predominant tool utilized to ensure compliance with a QMS is the quality audit - systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled. Auditing makes companies (and those employees and suppliers working within its structure) accountable for the quality they provide.

**The importance of audits as a management tool:** The ISO 9000 (quality standard) and ISO 14000 (environmental standard) International Standards emphasize the importance of audits as a management tool for monitoring and verifying the effective implementation of an organization's quality and/or environmental policy. Audits are also an essential part of conformity assessment activities such as external certification/registration and of supply chain evaluation and surveillance.

**Internal auditing for improvement:** The “audit for improvement” scenario recognizes that the internal auditor and the auditee are on the same team, with the common objectives of compliance and improved processes that address efficiency, minimization of risk, maximization of safety, all so that the process and the company can survive and thrive.

**The intended reader of this document:** The target audience for this document is concrete construction professionals that see the need to introduce systematic auditing to their organization. This document will emphasize the twin objectives of compliance and improvement for large or small companies in our industry. The subject of auditing will be covered from the general to the specific – eventually to the level of example check lists and templates for procedures for various aspects of the concrete construction industry audits. The guidelines for auditing in this document are intended to be flexible.



# Guidelines for quality auditing

## 1 Scope [Draft A ready for subcommittee review]

[Note to writers of this ACI document: Words that are greyed out are initially provided directly from ISO 19011 (source document) and are left in for context and will be revised in the process of writing this document. Once the section has been edited, the characters will be changed to normal darkness font color.]

This document provides guidance to members and readers of this ACI document on the principles of auditing, managing audits, conducting quality management system audits, as well as guidance on the competence of quality management system auditors.

Guidance provided in this document is applicable to all organizations needing to conduct internal or external audits of quality management systems or to manage an audit.

The application of these guidelines is intended specifically for the construction and concrete construction industry per the sphere of influence of the American Concrete Institute (ACI).

## 2 References [Draft A ready for subcommittee review]

The following documents (the International Standards for quality) are the basis for the information contained in this document.

ISO 9000:2005, *Quality management systems - Fundamentals and vocabulary*

ISO 9001:2008 – *Requirements*

ISO 19011 – *Guidelines for quality and/or environmental management systems auditing*

Additional reference material has been provided by:

*ISO 9001:2008 Internal Audits Made Easy by ASQ and Ann Phillips.*

## 3 Terms and definitions [Draft A ready for subcommittee review]

For the purposes of this document, the terms and definitions given below apply. Organizations are encouraged to utilize these definitions provided and to edit and add as befits their organization.

**Audit:** systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.

**NOTE 1 - Internal audits** - sometimes called first-party audits, are conducted by, or on behalf of, the organization itself for management review, for process improvement and for compliance, and may form the basis for an organization's self-declaration of conformity. In many cases, particularly in smaller organizations, independence can be demonstrated by the freedom from responsibility for the activity being audited.

**NOTE 2 - External audits** - generally termed second- and third-party audits. Second-party audits are conducted by parties having an interest in the organization, such as customers, or by other persons on their behalf. Third-party audits are conducted by external, independent auditing organizations, such as those providing registration or certification of conformity to the requirements of ISO 9001.

**Auditee:** organization (or person representing the process) that is being audited

**Auditor:** person with the competence to conduct an audit.

**Audit Criteria:** set of policies, procedures, or requirements used as a reference.

**Audit Findings:** results of the evaluation of the collected audit evidence against audit criteria. [Note: Audit findings can indicate either conformity or nonconformity or opportunities for improvement (OFI).]

**Audit Plan:** description of the activities and arrangements for an audit

**Audit Program:** set of one or more audits planned for a specific time-frame and directed towards a specific purpose.

**Audit Scope:** extent and boundaries of an audit

**Corrective Action:** action to eliminate the cause of a detected nonconformity or other undesirable situation to prevent recurrence.

**Deficiency (also identified as a Construction Deficiency or Minor Nonconformance):** a physical work item or condition identified by project personnel that is not in compliance with the plans and specifications and which has predetermined remedial action by means of existing specification, previous closed NCR, or by an approved repair procedure.

The deficiency is referring typically to the physical works done by the contractor or any subcontractor and identified during monitoring and/or inspection by the project team. Deficiencies are typically logged, monitored, and ultimately closed by project field personnel.

**Disposition:** process of identifying a proposed correction for a NCR in order to bring the item into compliance with project requirements. This term has the same meaning as the term Resolution.

**NCR:** Non-Conformance Report documenting a non-conformity

**Non-conformity (NC):** An item that does not conform to any one of the following: ISO 9001 (if utilized for the project), contract, project or procedure requirements, plans or specifications - caused by the Auditee and disclosed during the audit and:

- modifies or may modify the final quality of the work relative to the quality requirements of the Project, and
- (with regard to physical NC), no formal method of repair or Resolution has been determined.

**Opportunity for Improvement (OFI):** An OFI is a documented notification to the auditee that may be issued by the auditor when a process is seen to be in danger of delivering a non-conforming product due to elements of a procedure or process that is not well defined, is vague, or is deemed to be insufficient to deliver conformance to specifications. The Auditee is encouraged to review the findings and undertake such modifications to its procedures and processes as necessary to address the issue. OFI's are typically issued to address process deficiencies only and are not to be used for physical deficiencies or NCR's.

**Quality System Procedure (QSP) (sometimes called Quality Management Procedures):** A procedure that details the methodology for a particular process related to the Quality Management System (QMS).

**Resolution:** The process of identifying a proposed correction for a NCR in order to bring the item into compliance with Project requirements. This term has the same meaning as the term Disposition.

**Technical expert:** person who provides specific knowledge or expertise to the audit team

NOTE 1 Specific knowledge or expertise is that which relates to the organization, the process or activity to be audited, or language.

NOTE 2 A technical expert does not act as an auditor in the audit team.

**Work Method:** Also called work procedures or work instructions

## 4 Principles of Auditing [Mihaela]

### From Mihaela

To enable different auditors to reach similar conclusions in similar circumstances and to ensure effective audits, clause 4 of ISO 19011 – Guidelines for quality and/or environmental management system auditing, introduces 5 principles of auditing as being **Ethical Conduct, Fair Presentation, Due Professional Care, Independence and Evidence-Based Approach**.

Continual review and application of these principles will keep auditors on track and will allow for objective, systematic and independent audits.

The **Ethical Conduct** is being related to the foundation of professionalism. Under this principle, actions that may influence the outcome of an audit should not be used. Auditors need to be honest, maintain integrity and confidentiality of information, be discrete - sensitive to the organization's culture, respectful.

**Fair Presentation** refers to the obligation of reporting truthfully and accurately. This will include reporting audit findings as well as significant obstacles or difference of opinions encountered during an audit.

**Due Professional Care** includes the application of care, diligence, follow-through in all matters related to the audit, Personal preferences should be avoided, rather the auditor shall refer to applicable standards, procedures and/or specifications.

**Independence** requires audits to be performed by auditors that are independent of the activity being audited, are free from bias or conflict of interest. This will allow auditors to be maintain objectivity and be impartial to audit findings.

**Evidence-Based Approach** means the information gathered during the audit is verifiable. Auditors must collect factual information. The collected evidence needs to be authentic.

**End Mihaela**

**From ISO 19011**

Auditing is characterized by reliance on a number of principles. These make the audit an effective and reliable tool

in support of management policies and controls, providing information on which an organization can act to improve

its performance. Adherence to these principles is a prerequisite for providing audit conclusions that are relevant and sufficient and for enabling auditors working independently from one another to reach similar conclusions in similar circumstances.

The following principles relate to auditors.

a) **Ethical conduct:** *the foundation of professionalism*

Trust, integrity, confidentiality and discretion are essential to auditing.

b) **Fair presentation:** *the obligation to report truthfully and accurately*

Audit findings, audit conclusions and audit reports reflect truthfully and accurately the audit activities.

Significant obstacles encountered during the audit and unresolved diverging opinions between the audit team and the auditee are reported.

c) **Due professional care:** *the application of diligence and judgement in auditing*

Auditors exercise care in accordance with the importance of the task they perform and the confidence placed in them by audit clients and other interested parties. Having the necessary competence is an important factor.

Further principles relate to the audit, which is by definition independent and systematic.

d) **Independence:** *the basis for the impartiality of the audit and objectivity of the audit conclusions*

Auditors are independent of the activity being audited and are free from bias and conflict of interest. Auditors maintain an objective state of mind throughout the audit process to ensure that the audit findings and conclusions will be based only on the audit evidence.

e) **Evidence-based approach:** *the rational method for reaching reliable and reproducible audit conclusions in a systematic audit process*

Audit evidence is verifiable. It is based on samples of the information available, since an audit is conducted during a finite period of time and with finite resources. The appropriate use of sampling is closely related to the confidence that can be placed in the audit conclusions.

The guidance given in the remaining clauses of this International Standard is based on the principles set out above.

**End ISO 19011**

## 5 Purpose of External Audits – Compliance [Mihaela/Jim]

### From Mihaela

**External Audits** refer to audits conducted on a supplier or when an organization is audited by the customer, may include regulatory compliance/conformance, standards and/or specifications compliance/conformance, certifications, registration audits (such as ISO 9001 registration).

**External Audits** can include second-party audits and third party audits. A second-party audit is considered an audit performed on a supplier by or on behalf of the customer. A third-party audit is considered to be an audit performed by a party that does not act on behalf of the customer or the supplier (for example, an audit performed by the ISO registrar).

**External Audits** are mainly focused on compliance more so than on improving the audited organization. Exceptions would be when the customer and the supplier have developed a long term relationship and the customer is interested in further developing the supplier capability.

Generally the term “compliance” refers to adherence to regulatory requirements, while the term ‘conformance’ refers to adherence to standards, procedures, specifications, work methods/instructions.

As part of the auditing processes, **Surveillance Audits** are used for monitoring or observing to verify whether an item, activity meets the requirements.

Another method of verifying the control and processes a supplier applies on an item, service, facility can be a **Survey**. The frequency of conducting **Surveys** can be established based on regulatory or contractual requirements, complexity of item or service, performance history, procurement frequency, etc.

## 6 Purpose of Internal Audits – Compliance and Improvement [Mihaela/Jim]

[This item in particular be given its place to describe how the improvement process can be planned into audits.]

### From Mihaela

An Internal Audit, also called First Party Audit is performed within an organization with the intent of verifying compliance against internal procedures and standards and/or external standards used by the organization. Additionally, through auditing the performance of the organization, internal audits can bring value and promote continual improvement.

More mature organizations focus more on effectiveness and continual improvement with a shift from compliance to performance (compliance being considered embedded in performance). These audits are considered management tools and drivers to continual improvement, Under these circumstances, auditees are sharing experiences, more efficient processes, problem solving.

## 7 Managing an audit programme [ Mihaela]

### From ISO 19011

#### **7.1 General**

An audit programme may include one or more audits, depending upon the size, nature and complexity of the organization to be audited.

An audit programme also includes all activities necessary for planning and organizing the types and number of audits, and for providing resources to conduct them effectively and efficiently within the specified time frames. The organization’s top management should grant the authority for managing the audit programme.

Those assigned the responsibility for managing the audit programme should

- a) establish, implement, monitor, review and improve the audit programme, and
- b) identify the necessary resources and ensure they are provided.

Figure 1 illustrates the process flow for the management of an audit programme.

#### **Figure 1 — Illustration of the process flow for the management of an audit programme**

NOTE 1 Figure 1 also illustrates the application of the Plan-Do-Check-Act methodology in this International Standard.

NOTE 2 The numbers in this and all subsequent figures refer to the relevant clauses of this International Standard.

Two or more auditing organizations may cooperate, as part of their audit programmes, to conduct a joint audit.

### **Practical help — Examples of audit programmes**

Examples of audit programmes include the following:

- a) a series of internal audits covering an organization-wide quality management system for the current year;
- b) second-party management system audits of potential suppliers of critical products to be conducted within 6 months;
- c) certification/registration and surveillance audits conducted by a third-party certification/registration body on an environmental management system within a time period agreed contractually between the certification body and the client.

An audit programme also includes appropriate planning, the provision of resources and the establishment of procedures to conduct audits within the programme.

## **7.2 Audit programme objectives and extent**

### **7.2.1 Objectives of an audit programme**

Objectives should be established for an audit programme, to direct the planning and conduct of audits.

These objectives can be based on consideration of

- a) management priorities,
- b) commercial intentions,
- c) management system requirements,
- d) statutory, regulatory and contractual requirements,
- e) need for supplier evaluation,
- f) customer requirements,
- g) needs of other interested parties, and
- h) risks to the organization.

### **7.2.2 Extent of an audit programme**

The extent of an audit programme can vary and will be influenced by the size, nature and complexity of the organization to be audited, as well as by the following:

- a) the scope, objective and duration of each audit to be conducted;
- b) the frequency of audits to be conducted;
- c) the number, importance, complexity, similarity and locations of the activities to be audited;
- d) standards, statutory, regulatory and contractual requirements and other audit criteria;
- e) the need for accreditation or registration/certification;
- f) conclusions of previous audits or results of a previous audit programme review;
- g) any language, cultural and social issues;
- h) the concerns of interested parties;
- i) significant changes to an organization or its operations.

## **7.3 Audit programme responsibilities, resources and procedures**

### **7.3.1 Audit programme responsibilities**

The responsibility for managing an audit programme should be assigned to one or more individuals with a general understanding of audit principles, of the competence of auditors and the application of audit techniques. They should have management skills as well as technical and business understanding relevant to the activities to be audited.

### **7.3.2 Audit programme resources ???**

When identifying resources for the audit programme, consideration should be given to

- a) financial resources necessary to develop, implement, manage and improve audit activities,
- b) audit techniques,
- c) processes to achieve and maintain the competence of auditors, and to improve auditor performance,
- d) the availability of auditors and technical experts having competence appropriate to the particular audit programme objectives,
- e) the extent of the audit programme, and
- f) travelling time, accommodation and other auditing needs.

### **7.3.3 Audit programme procedures ???**

Audit programme procedures should address the following:

- a) planning and scheduling audits;
  - b) assuring the competence of auditors and audit team leaders;
  - c) selecting appropriate audit teams and assigning their roles and responsibilities;
  - d) conducting audits;
  - e) conducting audit follow-up, if applicable;
  - f) maintaining audit programme records;
  - g) monitoring the performance and effectiveness of the audit programme;
  - h) reporting to top management on the overall achievements of the audit programme.
- For smaller organizations, the activities above can be addressed in a single procedure.

### **7.4 Audit programme implementation ???**

The implementation of an audit programme should address the following:

- a) communicating the audit programme to relevant parties;
- b) coordinating and scheduling audits and other activities relevant to the audit programme;
- c) establishing and maintaining a process for the evaluation of the auditors and their continual professional development, in accordance with respectively 7.6 and 7.5;
- d) ensuring the selection of audit teams;
- e) providing necessary resources to the audit teams;
- f) ensuring the conduct of audits according to the audit programme;
- g) ensuring the control of records of the audit activities;
- h) ensuring review and approval of audit reports, and ensuring their distribution to the audit client and other specified parties;
- i) ensuring audit follow-up, if applicable.

### **7.5 Audit programme records**

Records should be maintained to demonstrate the implementation of the audit programme and should include the following:

- a) records related to individual audits, such as
  - | audit plans,
  - | audit reports,
  - | nonconformity reports,
  - | corrective and preventive action reports, and
  - | audit follow-up reports, if applicable;
- b) results of audit programme review;
- c) records related to audit personnel covering subjects such as
  - | auditor competence and performance evaluation,
  - | audit team selection, and
  - | maintenance and improvement of competence.

Records should be retained and suitably safeguarded.

### **7.6 Audit programme monitoring and reviewing**

The implementation of the audit programme should be monitored and, at appropriate intervals, reviewed to assess

whether its objectives have been met and to identify opportunities for improvement. The results should be reported

to top management.

Performance indicators should be used to monitor characteristics such as

- | the ability of the audit teams to implement the audit plan,
- | conformity with audit programmes and schedules, and
- | feedback from audit clients, auditees and auditors.

**End ISO 19011**

## **8 Audit activities** (Incomplete) [Jim/Mihaela]

[April and October, 2012 document: stopped here]

[We agreed we would use the audit procedures that we currently have between us (Mihaela and Jim) – the above is already far to reliant on the ISO 19011 standard and we will have to make many changes to comply with a non-copyright position – or get permission to use it.]

[May: We agreed we would paraphrase the information from other sources that we may wish to include in our document.

### **8.1 General**

### **8.2 Initiating the audit**

### **8.3 Conducting document review [also contains the element of new vendor assessment]**

### **8.4 Preparing for the on-site audit activities**

### **8.5 Conducting on-site audit activities**

### **8.6 Preparing, approving and distributing the audit report**

#### **8.6.1 Preparing the audit report [including NCRs and corrective actions]**

#### **8.6.2 Approving and distributing the audit report**

### **8.7 Completing the audit**

### **8.8 Conducting audit follow-up**

### **8.9 Audit Template Procedures**

The subcommittee has provided 6 template procedures for conducting audits. (See attachments.) They are named as follows:

7. QMP-010 Audit Procedure
8. QMP-010A Audit Agenda Form
9. QMP-010B Audit Checklist
10. QMP-010C Audit Schedule
11. QMP-010D Audit Report Form
12. QMP-010E Audit Log – Audits & NCR's

## **9 Competence and evaluation of auditors** (Incomplete) [Mihaela]

### **9.1 General**

### **9.2 Personal attributes**

### **9.3 Knowledge and skills**

### **9.4 Education, work experience, auditor training and audit experience**

### **9.5 Maintenance and improvement of competence**

### **9.6 Auditor evaluation**

## **10 Audit Checklist Templates – Common Processes**

- 10.1 Audit of Quality Management System Processes** [text description of the system audit]
- 10.2 Management commitment**
- 10.3 Document control**
- 10.4 Record Control**
- 10.5 Communication**
- 10.6 Management review**
- 10.7 Training [Tom]**

### **10.7 – Training**

The gist of this requirement is that personnel be qualified and trained to perform their duties. Although industry certifications do not cover every aspect of the work, they are a good indicator of the qualifications of workers, organizations, and inspection personnel.

#### For Craft:

With respect to craft labor, the unions usually take the initiative to train workers thru apprenticeship programs and qualification exams. Contractors may build upon this for their own construction specialties as well as safety. With respect to concrete, the American Concrete Institute (ACI) offers certification programs as such as Concrete Flatwork Finishers /Technician, Chemical Anchor Installer, Shotcrete Nozzleman, and Tilt-up Supervisor/Technician. Some State DOT's offer their own certifications programs for craft, among these are certification for concrete batchers. The National Ready Mix Concrete Association (NRMCA) also offers certification of batching operators, plant managers, and three (3) levels of Concrete Technologist. The Post Tensioning Institute (PTI) has worker qualifications programs.

It needs to be pointed out that as per the American Welding Society (AWS), welding of reinforcing steel requires special qualification of both the procedure and the personnel. Qualification for welding mild steel rolled sections and plate does not cover this requirement, because those materials have compositions different from reinforcing steel.

#### For Organizations:

Suppliers and subcontractors as companies can hold certifications sponsored by professional organizations. The National Ready Mix Concrete Association (NRMCA) offers a Plant Certification Program that is conducted via audit by an independent professional auditor. Batch plant certifications are usually required by State DOT's who will send inspectors to certify plants on a yearly basis. Local specifications will often specify State DOT or NRMCA certification as a contract requirement. The Precast Concrete Institute (PCI) certifies precast plants in several product categories, and also has a Certified Erector Program. The PCI audits these for compliance semi-annually. The International Code Council (ICC) offers three levels of the National Standard Building Contractor Certification. Testing labs are certified under a number of different organizations to confirm their compliance with ASTM C 1077. These certifying organizations include the AASHTO Material Reference Laboratory (AMRL), the National Voluntary Laboratory Accreditation Program (NAVLAP) and the American Association for Laboratory Accreditation (A2LA) to name a few.

#### For Quality Management and Inspection and Testing Personnel:

Quality Management personnel, such as Engineers, Managers and Auditors, can be certified by Organizations such as the American Society for Quality (ASQ). Typical certifications are Certificated Quality Engineer (CQE), Quality Manager (CQA), and Quality Auditor (CQA). These certifications are often required by contract quality clauses.

Inspectors and testing technicians usually need to be certified for their work. Programs are available from ACI, PCI, PTI, and ICC. The ACI offers Field Testing Technician Grade 1 (the basic concrete field testing certification); Concrete Strength Testing Technician; Aggregate Testing Technician Levels I & II; Concrete Construction Special Inspector; and Concrete Transportation Construction Inspector (the latter two qualifying personnel to manage all aspects of a program). The PCI offers three levels of Quality Control



Technician/ Inspector as well as Certified Field Auditor and Certified Company Auditor. The PTI certifies inspectors for postensioning inspection. The ICC also offers Special Inspector certification programs for reinforcing inspection and precast fabrication and erection.

For Job Site Personnel:

In the interest of effective communication, it may be appropriate to train job site production managers in the objectives of the Quality Program, especially if they will be expected to participate in inspecting either their own work or that of their peers. This training can be simple and to the point, such as providing self explanatory checklists and clarifying the responsibilities.

<u>Organization</u>	<u>For Craft</u>	<u>For Organizations</u>	<u>For Quality Management and Inspection and Testing Personnel</u>
ASQ			<ul style="list-style-type: none"> <li>• Certified Quality Engineer</li> <li>• Certified Quality Manager</li> <li>• Certified Quality Auditor</li> </ul>
ACI	<ul style="list-style-type: none"> <li>• Flatwork Finisher</li> <li>• Chemical Anchor Installer</li> <li>• Shotcrete Nozzleman</li> <li>• Tilt Up Supervisor</li> </ul>		<ul style="list-style-type: none"> <li>• ACI I Field Testing Tech</li> <li>• Concrete Strength Testing Tech</li> <li>• Aggregate Testing Tech I &amp; II</li> <li>• Concrete Construction Special Inspector</li> <li>• Concrete Transportation Construction Inspector</li> </ul>
NRMCA	<ul style="list-style-type: none"> <li>• Batching Operators</li> <li>• Batching Plant Manager</li> <li>• Concrete Technologist</li> </ul>	<ul style="list-style-type: none"> <li>• Batch Plants</li> </ul>	
PCI		<ul style="list-style-type: none"> <li>• Precast Plants</li> <li>• Certified Precast Erector</li> </ul>	<ul style="list-style-type: none"> <li>• Quality Control Technician/Inspector</li> <li>• Certified Field Auditor</li> <li>• Certified Company Auditor</li> </ul>
PTI	<ul style="list-style-type: none"> <li>• Iron Worker</li> <li>• Field Installation Slab on Ground Stressor</li> </ul>	<ul style="list-style-type: none"> <li>• Plant Certification</li> </ul>	<ul style="list-style-type: none"> <li>• Inspector</li> <li>• Field Specialist</li> </ul>
AWS	<ul style="list-style-type: none"> <li>• Sanctioned programs thru authorized facilities</li> </ul>		<ul style="list-style-type: none"> <li>• Certified Welding Inspector</li> </ul>
ICC		<ul style="list-style-type: none"> <li>• National Standard Building Contractor A, B, or C</li> </ul>	<ul style="list-style-type: none"> <li>• Reinforced Concrete Special inspection</li> <li>• Precast Concrete Special Inspector</li> </ul>
CRSI		<ul style="list-style-type: none"> <li>• Epoxy Coating Plant Epoxy Coating Plant</li> </ul>	
State DOT's		<ul style="list-style-type: none"> <li>• Batch Plants</li> </ul>	
AMRL, NAVLAP, A2LA		<ul style="list-style-type: none"> <li>• Testing Lab Certification to ASTM C 1077</li> </ul>	

The subjects of specific audit checklist questions would be fashioned according to the nature of the relevant type of work, but a general audit checklist for Training, to be followed by more specific questions and documentation checks could be presented as follows:

For Craft:

1. Do you have site orientation training for incoming personnel to each site?
2. How do you determine the qualifications of craft labor?
3. What certifications and/or training do you require or obtain for craft? Do you supply the training for this or does the union?
4. Do you keep a file on the certifications / qualifications of each worker?

For Organizations

1. Does your company hold certifications as a specialty contracting entity?
2. Does your company have a standing training arrangement with a union, trade school, or other training entity?
3. Do you have a training program for managers? What does it entail? Does it include the Quality and Safety Programs as well as the other topics necessary for operations?
4. Do you require subcontractors, vendors, and suppliers to hold certifications, specialized training, specific experience, or trade organization membership?

For Quality Management and Inspection and Testing Inspection Personnel

1. What are the qualifications of your Quality Manager?
2. Do you employ your own testing and inspection technicians? Do their qualifications and certifications comply with their duties?

**10.8 Contract management (with owner) (including change control) [Tom]**

**10.9 Supplier and subcontractor management (including purchasing and change control) [Tom]**

**10.9 – Supplier and Subcontractor Control**

It is advantageous to be methodical in dealing with subcontractors, fabricators and material vendors. Often assumptions are made in terms of the nature of the agreements, specifications are not clearly understood and accommodated, and over commitments are made at the expense of the schedule and good workmanship. Good practice requires the following considerations:

Purchasing Data

It important to ensure that all required information is sent to vendors and documents are maintained of what was transmitted so that there is always a record of what was purchased for the price quoted. Items of concern are the specific drawings transmitted, the specifications covered, process requirements, inspection and acceptance criteria, personnel qualifications, schedule requirements. Any modifications to the base agreement would follow the same pattern.

Evaluation and selection

A procedure, not just a policy, needs to be place for evaluation of vendors. The level of assessment would depend on the criticality of the service or materials and the history and relationship with the vendors being considered.

Some of the elements to be given consideration in such a procedure would be:

1. Past performance to include schedule compliance This can be based on a formalized company system of vendor evaluation
2. Quality of workmanship based on external audits and tracking of nonconforming items of work
3. Performance for previous clients
4. Survey of the facility
5. Registration / certification by professional agencies such as ISO, NRMCA, ACI, etc.
6. Dispute resolution
7. Management structure to include Quality and Safety as well as Production. This would include the level of detail, applicability, and execution of the Quality Plans provided.
8. History of over any commitment and failure to perform due to stretching of resources.

Maintaining an *approved suppliers list* based on a formalized end of project evaluation system is beneficial to an organization in making these selections

### Contracts Review

Contract Review requires that one take the time to look over contracts before finalizing agreements. There should be procedure in place for review all contracts prior to entry. This includes subcontracts and vender agreements.

Is the procurement contract structured to assign more risk to one entity or the other? Is the vender capable of the delivery as expected? Will he be able to make a profit? The failure of a vender can kill the job or place extra costs for completion on the General Contractor. Have all the correct drawings and specifications been included in the agreement? Is everything included in the proposal, so there no surprises? A method of assessment and documentation needs to be in place, so one can determine what went right or wrong and why. Source inspections and shop release requirements should be defined in the contract if necessary to ensure delivery of an adequate product. If authorization to ship is required, it should so be stated.

And the requirements for quality management need to be well defined in the contract language to include submission of a plan, qualifications and approval of quality personnel, references and supporting documents, and customer's rights to audit and access to facilities.

### In process Controls

Verification inspections and surveys of production should be completed by the customer.

External audits need to be conducted to ensure compliance with the intent of the submitted vender Quality Plan. Nonconformances need to be tracked to indicate any undesirable trends in the suppliers operation.

### Change Control

There needs to be formalized method by which changes to the contract are brought to the supplier's attention, additional costs determined, impacts to schedule assessed, and revisions added to the contract documents, and payments made to the contractors.

### Questions:

1. How do you ensure that all data transmitted to prospective vendors is complete, well defined, understood, and documented? How do you ensure the final agreement clearly includes all the requirements?
2. What is the procedure for evaluation and selection of vendors (subcontractors, services, fabricators, material, and equipment suppliers? Is there a List of Approved Vendors? How is it determined? What do you look for?
3. How do you conduct review of subcontracts?
4. What are your methods of control and tracking of vender performance?
5. What is done for offsite verification of product (materials, fabricated items, etc.)?
6. What is the process by which you control changes to the contract requirements and the follow through to vender agreements and execution?
7. How do you record vender performance for reference in future procurements?

## 10.10 Process Control (Work Methods) (Procedures) [Tom]

### 10.10 – Process Control

A process is defined as “a set of interrelated resources and activities which transformer inputs into outputs. “ More simply put, it is the combination of all the planning, materials, and labor that make the product. If not carried out with a set of controls, the product could be unsatisfactory once complete.

It is best to carry out processes under a set of procedures to define the considerations for adequate control. These procedures should include:

1. The manner in which the work is carried out. This can be in the form of narrative for simple operations or with flow charts for more complex operations. Critical Path Method scheduling is a type of flow chart that shows the interrelationship of events to accomplish a task.
2. The steps in the process need to be defined as events and be subject to the following
  - a. Approvals of designs, working drawings, materials, and special processes
  - b. Manners of communication which would include a preplanning meetings, lookahead schedules, daily notifications of work.
  - c. Specific measurements and inspections with defined acceptance criteria
  - d. Hold points for acceptance, rejection, or rework
  - e. Designation of the entity with authority for acceptance or rejection
3. Scheduling for adequate coordination for materials, manpower, engineering, approvals, logistics, weather, and demand for completed product.
4. Equipment and equipment maintenance requirements
5. Environmental conditions such as hot and cold weather work and rainy season flat work.

Of special concern are characteristic of the product that cannot be determined until a later date. An example of this is the strength and durability of concrete which is determined typically 28 days after the placement. Typical batching inspection and acceptance testing fill this requirement as a process control in that the tests conducted give an indication of future product quality.

Also of concern are characteristics that cannot be determined once the product is complete, so it must be inspected or tested in process. Placement of reinforcing falls into this category. So it must be inspected, approved, and documented as the process proceeds.

A typically employed Process Control System is the three phase approach.

1. The **Preparatory Phase** can include drawings and specifications review; examination of the work area and site conditions; inspection of materials; preplanning (“kick off”) meetings; approvals of working drawings, materials, samples, mock ups, and proposals for alternate methods; verification of worker and inspection qualifications; identification of hold points; definition of inspection methods and acceptance criteria; procurement of testing and inspection labs; assembly of a look ahead schedule.
2. The **Initial Phase** concerns the checking of the start up work to verify compliance, confirm acceptable levels of workmanship and resolve discrepancies. In manufacturing it is often referred to as “first article inspection” and is used to verify planning assumptions and production capabilities.

3. The ***In Process Phase*** is the implementation of the normal testing, inspection, and process control to ensure requirements continue to be met, craft is performing as planned and required witnessing and hold points are satisfied. Results of tests and inspection should be reviewed for trends.

Questions:

1. Do you hold kick off meetings for each change in operations such as excavation to foundation work, or foundations to superstructure? Who comes to these meetings? Is there an agenda made up and sent out to all? Do you write minutes?
2. Do you have flow charts or CPM to define the sequence of operations, equipment and manpower allocation, material deliveries, and required approvals?
3. Do you make up a look-ahead schedule for the upcoming two to six weeks?
4. Do you have a system of daily notifications for the owner's representatives, material suppliers, owner's representatives, testing labs, and job site management?
5. Do you have defined procedures for hold points to include testing and inspection methods, acceptance criteria, and documentation requirements? Do you have checklists and inspection and testing records? Do you have a system for trending results (data bases, nonconformance reports, customer complaints files, etc)?
6. Do you instructions for workers on how to handle, store, and place reinforcing steel to avoid damage and problems sequencing and locations?
7. Do you have work instructions for conveyance equipment use, placement and compaction methods, and job site additions to mix deliveries, and curing?
8. Do you have procedures to accommodate environmental and weather conditions not conducive to concrete work?
9. Do you have a list of company owned equipment with maintenance records?

### **10.11 Calibration [Tom]**

#### **10.11 – Calibration (Control of Measuring and Testing Equipment)**

An organization using equipment for measurements has to have assurance that measurements are accurate, especially when equipment is subject to wear and tear. Calibrations (control of measuring and testing equipment) can include read outs of data such as gauges on a pressure gauge or a compression testing machine. Or they could include simple ruler measurements to check deformation. Such is done on a worn slump cone or set of aggregate gradation screens. These calibrations have to be logged, the documentation collected and filed, and the equipment clearly marked with the calibration date and calibrating entity. Logs should also show the next calibration date. Calibration intervals are usually established by manufacturers of the equipment, contract requirements, or published industry standards such as ASTM.

Typical calibration intervals are as follows

Air pots	12 months
Rebar coupler torque wrenches	12 months
Scales	3 months
Thermometers	12 months
Compression Testing Machines	12 months
Survey equipment	12 months

The procedure by which the equipment is calibrated is the responsibility of the entity that uses it. It should follow written established standards. Though this can sometimes be beyond the user's technical capability, they are still responsible for procuring the service from an entity that is qualified in such work.

It is necessary that calibrations and measurement checks are traceable to a known source of reliability. Some field equipment, such as thermometers and pressure gauges, can be calibrated from "masters", which have been calibrated off site from traceable measurements. Often contracts will require traceability to the National Institute of Standards and Technology (NIST) which calibrates devices to be used as measurement standards. Lab equipment is usually calibrated off these standards, because accuracy is important. Pressure type air entrainment meter pots can be field calibrated with the measuring equipment supplied with the accessories. Torque wrenches should be sent out to a lab. Tapes and rulers can be calibrated and by specification, probably should be. But this is not usually done, as it is not considered critical.

Equipment overdue for calibration should be removed from service.

Equipment found to be out of calibration and giving incorrect readings subjects all previous measurement data to doubt. Therefore, a procedure should either be in place or specifically developed to investigate the uncertainty of the data. Such a procedure could include methodically re-measuring representative samples or rejecting the entire production run.

Audit questions would be specific to the type of work being investigated along with its measuring equipment. However, the principles of calibration are basic to almost all measuring and testing equipment. Starting audit questions can be as follows:

1. Do you have a log of your equipment? Does it contain the make, model, serial number, year of manufacture, and date of the last calibration? Does it contain the next scheduled calibration interval? How is the recalibration interval determined?
2. Do you have the calibration certificates for the equipment?
3. Is the calibration traceable to an established organization such as the National Institute of Standards and Technology?
4. Do you label the measuring equipment that has been calibrated with the date and person or company that did the calibration?
5. What is your procedure for addressing measurements and tests made by a device that is found to be out of calibration at the time

**10.12 Internal and External Audits (to see that the auditee is conducting audits)**

**10.13 Control of Nonconformance and Corrective Action**

**10.14 Control of deficiencies**

**10.15 Statistical Analysis - trending**

**10.16 Continuous Improvement [tracking, pre-work improvement plans],**

**10.17 Preventive Action (Risk Management) [preconstruction and Work Method review meetings]**

## **11 Audit Checklist Templates – Concrete Construction Processes**

- 11.1 Design**
- 11.2 Detailing of Reinforcing**
- 11.3 Mix Design and Development**
- 11.4 Manufacture of Materials**
  - 11.4.1 Cement**
  - 11.4.2 Aggregate**
  - 11.4.3 Admixtures**
  - 11.4.4 Reinforcing**
- 11.5 Batching and Delivery**
- 11.6 Lab Testing and Field Testing**
- 11.7 Construction**
  - 11.7.1 General including preparation**
  - 11.7.2 Mixes**
  - 11.7.3 Formwork**
  - 11.7.4 Placement of Reinforcing**
  - 11.7.5 Acceptance Testing**
  - 11.7.6 Concrete Placement**
  - 11.7.7 Curing**
  - 11.7.8 Record Keeping ???**
- 11.8 Precasting**
- 11.9 Post tensioning**
- 11.10 Shotcrete**

### Attachments;

1. QMP-010 Audit Procedure
2. QMP-010A Audit Agenda Form
3. QMP-010B Audit Checklist
4. QMP-010C Audit Schedule
5. QMP-010D Audit Report Form
6. QMP-010E Audit Log – Audits & NCR's