

AN ANALYSIS OF THE IMPACT OF THE REVISED - BS EN ISO 9001:2000 UPON THE READY MIXED CONCRETE INDUSTRY OF THE UNITED KINGDOM

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The issue in 2000 of a completely revised international standard for Quality Management Systems imposed the requirement for a major change of mindset amongst all organizations currently certified to the former versions of ISO 9000:1994 Series. In particular, the philosophy of the new standard has introduced novel concepts such as customer-focus, dynamic leadership, increased personal involvement, more systematic management, continual improvement and mutually beneficial supplier relationships. The revised standard puts increased emphasis on management responsibility, resource management and monitoring of systems effectiveness. This paper reviews the changes which ready mixed concrete suppliers who are already certified by an accredited certification body have made to their quality systems in order to comply with the revised standard – which had to be done by the end of 2003. The author uses his extensive involvement with a range of UK concrete suppliers to illustrate the changing emphasis of quality assurance. In a type of Action Research, he draws on his experience in auditing 15 concrete companies over the period leading up to their transfer of certification to BS EN ISO 9001:2000 in December 2003 and beyond. He recommends how all certified organizations must adapt to the amended standard, regardless of their product, based on his knowledge of the actions taken recently within the ready mixed concrete industry. These may be used as a model for the entire construction industry in complying with the process-approach of the revised ISO 9001.

Keywords: Quality Management, Ready Mixed Concrete Industry, United Kingdom, BS EN ISO 9001:2000.

INTRODUCTION

The development of the latest version of the ISO 9000 series on Quality Management Systems has been documented elsewhere by Gunning (2000), Lawson (2003), Hoyle and Thompson (2004) and others. The major departure from previous editions of the standards is the publication of eight quality management principles which underpin the detail of the new edition, BS EN ISO 9001:2000. These are:

- 1 Customer focus
- 2 Leadership
- 3 Involvement of people

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- 4 Process approach
- 5 System approach to management
- 6 Continual improvement
- 7 Factual approach to decision making
- 8 Mutually beneficial supplier relationships

Regrettably these principles do not constitute auditable requirements, so quality auditors must avoid interpreting management systems based on their personal view of these eight elements. These have been identified as providing a framework towards improved performance of an organization and helping it to achieve sustained success.

The new standard has embodied a number of modern management concepts such as supply chain management, continual improvement (as in Total Quality Management), customer satisfaction measurement, benchmarking and a process-based approach. In many ways, effective implementation of quality assurance has long been focussed on processes, but historically there have been many examples of inappropriate emphasis upon 'correct' documentation rather than upon the process of business improvement.

The change of title of the new ISO 9000 series from Quality Assurance to Quality Management Systems encapsulates the move away from the procedure-driven system of earlier versions. ISO 9001:2000 only requires 6 documented procedures (as a minimum), and has amended the emphasis from controlling paperwork to controlling activities. This has made the standard much more 'user-friendly', particularly to smaller organizations.

The new version also reduced the consumption of paper by comprising only four standard documents instead of the original 21. These are:

ISO 9000:2000 QMS – Fundamentals and vocabulary

ISO 9001:2000 QMS – Requirements

ISO 9004:2000 QMS – Guidelines for performance improvements

ISO 19011:2002 – Guidelines for auditing management systems

It is intended to match management expectations, and to be aligned to typical management processes. It is also broadly compatible with ISO 14001:1996 for Environmental Management Systems, so integrated systems are being encouraged at long last.

The new standard encompasses much broader and more detailed scope for Management Responsibility, including the setting and monitoring of measurable objectives. Top management is required to show evidence of commitment to the system of quality management and to the provision of adequate resources. A theme of continual improvement runs through the entire standard based on the Deming (1994) principle of a 'Plan-Do-Check-Act' cycle. Measurements of customer satisfaction include a range of the same hard, fuzzy and soft requirements which originally comprised the customer's requirements. The revised standard places much greater responsibilities upon organizations to communicate with customers, identify and meet their needs, and to measure customer satisfaction.

The standard introduces a new flexibility in that it permits exclusion of selected production requirements and requires less rigid conformance to specified procedures.

This permits the development of a more appropriate and effective (process-based) quality management system.

For the purposes of this paper, the standard has been divided into five major sections, which will be examined in turn.

Sections 4	-	Quality Management System
5	-	Management Responsibility
6	-	Resource Management
7	-	Product Realization
8	-	Measurement, analysis and improvement

(Sections 1 – 3 of the standard cover scope, normative references, and terms and definitions, which are not particularly relevant here.)

The evolution of quality assurance practices in the ready-mixed concrete industry has been detailed elsewhere by Gunning (1989, 1997, 1998, 2000). The purpose of this paper is to examine the way in which the industry has adapted to the new ISO 9001 standard, and to draw conclusions as to how the revised standard will impact upon other sectors of the construction industry. Concrete producers had until December 2003 to obtain certification to ISO 9001:2000 through the Quality Scheme for Ready Mixed Concrete, according to Hall (2001). Hence, the results discussed only refer to the initial system established, and their performance in the very early months of implementation, as assessed by the author on behalf of QSRMC.

QUALITY MANAGEMENT SYSTEMS

ISO 9001:2000 requires the establishment, documentation, implementation, maintenance and continual improvement of a QMS with controlled processes and appropriate documentation. In particular, the documentation of quality policy, objectives and manual requires to have written procedures for control of documents, quality records and nonconforming product, as well as for internal auditing, corrective actions and preventive actions. Beyond this, the standard permits a high degree of flexibility to organizations in deciding which processes require to be documented.

The ready mixed concrete industry has been operating documented procedures since the introduction of the BRMCA Authorization Scheme in 1968, and has been operating to the Technical Regulations of the Quality Scheme for Ready Mixed Concrete since 1984. This includes compliance with the current versions of BS5750/ISO 9000 series, so the 2000 edition of ISO 9001 presented all companies with a major decision; whether or not to maintain the format of an ISO 9001:1994 manual and system or to redraft from scratch in the format of the new standard. In the event, the vast majority of concrete producers chose to move forward with the new framework, whilst those few who decided to stick with the original format found considerable difficulty in addressing all of the new requirements within the old-style manual. This also presents assessors and auditors with problems in identifying features of the QMS.

As Hoyle and Thompson (2004) found in other industries, there remain many problems when quality systems are designed to resemble the standard rather than the individual business, and these problems are compounded when a system resembling the older standard is being audited under the new one. The very existence of 3

separate elements of the ISO 9000:2000 series limits the effective integration of systems into a single interacting supra-system.

One beneficial outcome of the new standard is that organizations are now required to demonstrate the integration of their various processes – usually in the form of a flow chart in their manual. While processes no longer have to be fully documented, it is difficult to articulate a process clearly without a degree of documentation – even if it no longer needs to be so detailed. In practice, concrete producers have left their original procedures in place wherever appropriate, and have produced similar degree of detail within new procedures. In other words they had been conditioned to rely on fully documented procedures and preferred to continue to do so, even if this was no longer mandatory. This at least made the auditing of such procedures less rigid – with the exception of the 6 essential documented procedures referred to earlier.

The extent of the quality management system now depends upon the size of the organization, its type of activities, the complexity and interaction of its processes and the competence of its personnel. No formal structure or medium of documentation is stipulated within ISO 9001:2000, as the primary purpose of quality documentation is to express the Quality Policy and describe the QMS in detail. Quality records have the primary functions of documenting traceability and providing evidence of preventive and corrective action. They provide knowledge for maintenance and improvement of the system. The ready mixed concrete industry has broadly found no reason to significantly reduce the production, technical or commercial records, even where permitted by the new standard.

In summary, the effect of ISO 9001:2000 upon the QMS of concrete producers has been to make them initiate a revised quality manual with a new quality policy, and review the procedures and documentation employed. The latter have not changed significantly, so that once the new manual and policy had been approved as complying with the new standard, the companies generally resumed their former operating practices, updated as required.

MANAGEMENT RESPONSIBILITY

A major innovation of the revised standard is the requirement for senior management to demonstrate commitment to maintaining and improving the QMS, in particular through a clear quality policy and measurable quality objectives for all sectors of the business which are within scope. All the concrete producers in the present survey have produced single page policy statements, signed by the senior director or manager.

The definition of clear measurable objectives has presented more of a difficulty for the industry and some firms have not yet fully achieved this; broad objectives have existed for many years but these now need to be specific, measurable and covering all relevant functions and levels. Some companies have commenced measurement of the degree to which their objectives are being achieved, and it is hoped that repeated measurements will demonstrate a trend of continual improvement. Senior management must demonstrate that the QMS operates to enhance customer satisfaction, which is often manifested by fewer complaints and warranty claims.

This customer focus is mainly being demonstrated by surveys of selected customers using postal or staff delivered questionnaires. Some firms felt that postal questionnaires would provide more impartial responses than those completed in the company of a staff member. By contrast, other organizations considered that this was

a good opportunity for sales staff to contact customers and to market their companies' products through assessing the degree of satisfaction being felt by customers. Subjects within the questionnaires included delivery times, driver performance and other service issues as well as the product quality itself.

Senior management is also required to demonstrate how functions, interrelationships, responsibilities and authorities are defined, communicated and understood by all staff. This is normally done by means of an organization structure and a collection of job descriptions contained within the Quality Manual. There has to be an element of training in ensuring that all staff are now clear on their revised duties.

The role of the Management Representative (a senior manager who takes responsibility for operation of the QMS) is extremely important under ISO 9001:2000 and to QSRMC. He/she is required to control the audit and review process, promote awareness of customer requirements, ensure that staff are adequately trained, enforce preventive and corrective actions, and liaise with external parties on quality issues. ISO 9001:2000 has not been responsible for creating this role within QSRMC members, but it goes much further than its predecessor in stipulating detailed requirements for the role.

The final part of this section of the manual stresses the need for appropriate input and output for the review process. Inputs must include the results of audits, complaints, customer satisfaction surveys, product conformity, preventive and corrective actions and relevant changes. Outputs should centre on recommending improvements to the quality system, its processes, product realization, resources and customer satisfaction measures. In effect, this closes the loop of the quality management system for senior management.

RESOURCE MANAGEMENT

ISO 9001:2000 requires organizations to demonstrate provision of adequate resources to implement processes, improve their effectiveness and address customer requirements. Resources are classified as human resources (people) physical resources (plant and equipment) and the work environment, and are essential for the effective implementation of the organization's goals and objectives.

So far as human resources are concerned, the requirement is for organizations to demonstrate that all staff have the appropriate level of competence, awareness and training for the functions being undertaken. Personal training records are hence required for all staff – a more detailed requirement than in ISO 9001:1994. A few of the concrete companies were registered as Investors in People, and this IIP award practically guarantees full compliance with the revised standard regarding human resources. All other firms have had to upgrade and update their personnel records to demonstrate that relevant competencies have been attained by each employee.

Physical infrastructure resources include buildings, workspace and associated facilities, equipment, hardware and software plus any supporting services such as cleaning, transport and communication. Organizations are required to identify and maintain these in order to achieve conformity to product requirements. The only difficulty experienced by ready mixed concrete producers within this aspect tends to be the ongoing maintenance of plant and equipment to the level required to avoid a consequential risk of delivering non-conforming product to the customer.

The final element of the resources section of ISO 9001:2000 relates to the identification and management of the work environment so as to achieve product conformity. It expands upon the 1994 requirements and covers the range of heat, light, noise, protective equipment, hygiene, humidity, vibration, pollution, cleanliness, safety and ergonomics. These obviously relate closely to the other two elements of the section, but the demands of the standard only extend to preventing any contribution to product non-conformity rather than to any legal or ethical considerations.

PRODUCT REALIZATION

This section of the standard does not affect existing technical processes and sub-processes which are specific to production of the actual product in accordance with customer requirements. These are the core activities of a concrete producer and have been covered until recently by BS 5328 (1991). Coincidentally, these technical standards were totally revised at around the same time as the introduction of ISO 9001:2000; however, most ready mixed concrete producers chose a two-stage transition, completing their update to the new quality standard before revamping their technical systems to meet the new concrete standards of BS EN 206-1 (2000) and BS 8500:2000.

The net effect of this was that concrete producers who were already members of QSRMC (1998) had already in place adequate processes to satisfy the then current technical requirements of BS 5328:1991 for product conformity. The second part of the industry's two-stage transition is beyond the scope of this paper but it is fair to say that, in general, the upgrading of their quality systems caused many fewer difficulties for concrete producers than revising their technical processes to meet the very different terminology and arcane conformity rules of BS EN 206-1 (2000) and the complementary BS 8500 (2002). This is to be the subject of a future technical paper.

The main features of this section of ISO 9001:2000 relate to planning of the product realization processes, customer-related processes and communication, along with the design and development planning, inputs/outputs, review, verification of output and validation of the product in use. It also covers control of design changes, purchasing processes, identification and traceability, preservation of the product and control of measuring and monitoring devices. None of these were new requirements to firms such as ready mixed concrete producers who were already certified that QSRMC for product conformity to ISO 9001:1994, which included design of the product. Hence there is nothing new to report on product realization changes initiated because of ISO 9001:2000 itself.

MEASUREMENT, ANALYSIS AND IMPROVEMENT

In some ways, this section represents the core of the standard, dealing with process improvement and control of non-conforming product, as well as confirming the conformity of QMS with ISO 9001:2000. Organizations are required to determine methods for obtaining and using information relating to customer satisfaction. Concrete producers use a wide variety of methods beyond surveys – including level of complaints, repeat business, retention of customers, market testing and analysis of customer enquiries.

Another issue in this section is internal auditing, requiring definition of the audit criteria, scope, frequency and methodology. This differs little from the previous standard, other than the requirement for quality objectives to be established for each process being audited. The subsequent issue of ISO 19011:2002 covers the conduct of auditing in much greater detail, and must be followed by all involved in implementing ISO 9001 standard in any case. One additional area of auditing – that of the overall management system itself – has been a useful outcome of the revised ISO 9001.

Monitoring and measuring of processes to achieve the planned result represents a key principle to be applied across the quality system. Process performances may include timeliness, accuracy, reliability, cost reduction, throughput, technology, utilization and the effectiveness of personnel. Suitable measures of processes and product conformity need to be documented and completed so far as is possible prior to product release.

Non-conforming product must be identified and controlled to prevent unintended use or delivery, but in the case of ready mix concrete, the primary specified requirement of compressive strength of a hardened sample cannot be confirmed until some time after delivery and incorporation in a structure. As in the preceding issue of the standard, records and appropriate action in the case of non-conformance is essential. The major difficulty for the ready mixed concrete industry lies in achieving the specified consistence (workability), maximum water/cement ratio and minimum cement content for each delivery.

Analysis of data is required by the standard in order to provide information on the level of customer satisfaction, achievement of product requirements, performance of suppliers and trends in processes and product characteristics, together with identification of opportunities to prevent non-conformance. The concrete industry has long experience in most of these, with the former representing the most significant innovation among them.

Continual improvement of the QMS is demanded by the revised standard, through use of the quality policy, objectives, audit outcomes, analysis of data, corrective and preventive action and management review. This is essentially a Total Quality Management approach, and brings the ISO 9001:2000 standard much closer to this ideal (Wright, 2003). The concrete industry has generally found this new culture of continual improvement to be a shock to their systems, since earlier standards had represented something of a fixed bar to jump over; once cleared, it would be raised further, so their aim was to preserve the *modus operandi* as the status quo, with no need for further improvement.

Processes for corrective and preventative action did not have to be revised radically as a result of the revision to the standard. Identification, assessment, implementation, record and review of actions needed to correct or prevent non-conformities have been essential components of quality systems for many years. However, it is too early to say if use of these processes will assist in the demonstration of continual improvement within the ready mixed concrete industry. The guidelines for performance improvements embodied in ISO 9004:2000 should go along way towards achieving this, but it will take at least another one and a half years before most companies have sufficient data to demonstrate improvement.

CONCLUSIONS

The issue of ISO 9001:2000, along with its two sister publications of ISO 9000 and ISO 9004, has dramatically altered the scope of formal quality management systems. Requirements have generally become less definitive or prescriptive. Processes must be clearly defined and controlled, but with greater flexibility and less reliance on documented procedures. There is a new requirement to monitor customer satisfaction and a need to balance the competence of staff with the use of documented procedures. New requirements for internal communication, continual improvement and suitable infrastructure are consistent with modern concepts of management.

Lawson (2003) has blamed the relative failure of many quality management initiatives on the failure of organizations to accept cultural changes with the same enthusiasm as procedural aspects. ISO 9001:2000 requires firms to plan their processes, identify the key aspects and manage them appropriately. The major cultural changes arising from the new standard have been found to be

- the increased responsibilities of senior management
- the new focus on customer satisfaction
- more effective communication and training
- emphasis on an improved infrastructure and work environment
- measurement, analysis and improvement

These changes are very far from being merely 'cosmetic'. In many ways ISO 9001:2000 represents the foundation for a new beginning in the development of quality management systems (Lawson, 2003). It allows for easier integration with other management systems such as environment, health and safety, and information security which, when combined, must improve the performance of product and service for all concerned.

In the concrete industry, the major changes can be summarised as the need for quality objectives for production, technical and commercial processes, customer focus, quality policy, more comprehensive audits and management reviews, and a major change in culture to the realization that quality like safety, is the responsibility of everyone in the business.

The rest of the construction industry might learn from the experiences of the UK ready mixed concrete industry regarding quality management systems. There is much anecdotal evidence that many construction organizations pay only lip-service to quality systems – with major activity in updating documents and records in the period immediately prior to an audit. One way to limit this would be unannounced audits. The auditors themselves are considered by many to contribute to the ineffectiveness of many systems, either through extreme leniency or through slavish adherence to documentation regardless of its contribution to non-conforming products or services. External assessors may be equally responsible. There is much to be said for having industry – specific auditors/assessors who understand the technical complexities of construction processes, rather than those specialists who know every sub-clause of ISO 9001 by rote but who fail to understand the implications of particular processes for product conformity.

Transition to the new version of ISO 9001 has not been easy, and it will take some time before its benefits are fully achieved. The construction industry has a generally good record in adapting to change. Organizations will need to anticipate and manage the major changes brought about by the new standard if they are to be successful in

the future (Lazlo, 2000). Hopefully, construction as an industry will rise to the challenge of the culture shift required in moving from quality assurance (ISO 9001:1994), to quality management systems based on ISO 9001:2000 (Meegan, 1998). We need not wait long to find out!

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Gunning

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