The worried engineer’s guide to quality assurance

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Most engineers will by now have noticed a substantial bandwagon rolling in their direction, marked ‘quality assurance’. The cognoscenti call it ‘QA’, and there are QA contractors, QA managers, and QA registered firms. The British Standards Institution, at the Government’s behest, is promoting the idea heavily, producing a British Standard on the subject (BS5750) and running a Quality Assurance Services Department, which assesses and registers firms on the basis of their QA and encourages major clients to give work to registered firms.

What exactly is QA? Well, despite the name it is not a system for guaranteeing the quality of products and services; QA is the name given to a management philosophy which, its supporters claim, leads to improved quality. There is no denying their confidence - according to BS5750 essentially the same principles and methods can be applied to running everything, from a gravel pit to a consulting engineers’ office, or for doing anything from manufacturing nuts and bolts to designing a bridge. The sceptic may ask whether we need a British Standard for management - haven’t these generally concerned technical matters in the past? The cynic may ask how much BSI knows about the management of building work; he/she might even make unkind remarks about the quality of the Codes of Practice BSI produces for the technical side of building work.

Discussions about QA tend often to be dialogues of the deaf, with QA supporters arguing that ‘of course, better quality is a good thing’ and experienced builders and engineers expressing unease about the cost and paperwork involved, wondering whether the results will live up to what is claimed. After all, firms that produce good work come in all shapes and sizes and the quality of their work is not generally proportional to the amount of paper they generate.

What does QA mean for structural engineers?

As noted above, QA is a management philosophy, rather than a test of a firm’s competence. The general principles seem to be (a) make quality the responsibility of a manager who is independent of other functions such as production; (b) use formal, rather than informal, procedures (e.g. develop designs through periodic ‘design review’ meetings rather than letting them just evolve through normal supervision and discussion); (c) make checking and testing standardised and routine, rather than variable and discretionary; (d) write down everything that happens; and (e) ‘audit’ the resulting paperwork to see whether everything that should have been done is recorded as having been done.

In practice QA involves more than just promotion of the principles outlined above - the term covers several distinct initiatives, each with its own effects and side effects, pros and cons. Some of them (of doubtful merit) affect site management and others (probably more useful) concern materials supply but this article will concentrate on initiatives directed at the work of structural engineers.

Regulation of the profession

There is a proliferation of schemes for the registration of ‘firms of assessed capability’ under BS5750 for the production of all kinds of things, from duvets to drainpipes. So far, the only scheme for consulting civil and structural engineers is one operated by BSI, which has published a ‘Quality assurance schedule to BS5750: Part 1 Relating to civil and/or structural engineering led multidisciplinary engineering project design’ and is now registering consulting engineers as ‘firms of assessed capability’.

The biggest effect of the BSI scheme on consulting engineers may well not be the actual QA recommendations. It may be the effect on the regulation of our profession. QA-registered firms are encouraged to refer to it (and the BSI symbol) in marketing themselves and, as noted earlier, BSI is running an energetic campaign to encourage clients to use only QA-registered firms. The ethics of all this are very dubious - Institution rules prohibit members from claiming any superiority over one another - but if the campaign is successful the result may well be that firms will be forced to register if they are to get work. We may well end up with quasi-compulsory registration of engineers, operated not by our professional institutions but by BSI.
Even those who would applaud such an idea must worry about some of the details:

(a) Neither IStructE nor ICE was consulted in the preparation of the rules for the scheme. ICE offered to participate but was turned away by BSI.

(b) Registration is costly - for an office of 30-40 staff in Leeds BSI recently quoted an estimate of £4000, plus £1200 p.a. for renewals, and stated that offices in more remote areas would have to pay more.

(c) The published QA schedule is rather vague and lacking in detail, so much will depend on BSI’s assessors. The assessors may not be experienced in a firm’s area of work; some of them are not even chartered engineers. If a firm is rejected, it can appeal, but the appeals panel is selected by BSI, with no role for outside bodies such as the professional institutions. BSI refuses to reveal details of the background and qualifications of those who sit on such panels.

(d) The actual quality of work produced by a firm is not considered in the assessment - a firm which produces excellent work may be rejected simply because BSI’s assessors consider its management does not comply with BS5750.

QA in the office

Officially, the BSI QA schedule is applicable only to design work where the engineer is the project leader - a fairly unusual situation for most consulting structural engineers.

BSI seems to be happily registering structural engineering firms and encouraging clients to use them, although the basis for this is not clear - either the firms are applying their registration outside its stated scope (naughty, naughty!), or else they are only ‘switching it on’ for the appropriate projects. Although this is generally held to be undesirable, most structural engineers would probably have to switch QA on and off for different projects - not only do most carry out a lot of work outside the scope of the BSI scheme, but many jobs (e.g. reports) cannot really be fitted into the philosophy. In practical terms, QA registration should be possible for any firm, irrespective of its experience and capabilities. A firm needs only to comply with requirements about its management and the records it creates and keeps. Records required on a project in addition to the usual correspondence files, drawings, calculations, etc., are (i) a formal statement of the staff involved, their roles, their methods of work and documents to be used; (ii) a formal statement of the programme for the work and checks, etc., to be complied with before it can proceed from one stage to the next; (iii) results of calculations checks, drawing checks and design reviews, together with action taken; and (iv) lists giving the status of all documents at all stages. In addition, records have to be kept of staff training and experience, defects in previous designs, calibration tests on survey equipment and also of the procedures for handling, storing and inspecting the condition of the documents generated (!).

All these records must be kept for at least 10 years. One curiosity which surfaces in BSI’s ‘Brief guide to BS5750 for design organisations’ is a requirement (which does not appear in the quality assurance schedule) that, when revised documents (such as drawings) are issued, the superseded ones are all supposed to be recalled!

In its management, a firm is required to have a quality manager, responsible for the QA system, who is preferably independent of the various project directors. In running a project, the requirements are that (a) all the various documents referred to above have to be prepared; (b) in addition to normal design development, there have to be periodic, formal ‘design reviews’, with records of their conclusions and actions taken; (c) all calculations, drawings and amendments to drawings have to be checked; and (d) all the various QA forms and documents must be ‘audited’. Anyone who has done checking will know that ‘checking’ can cover anything from ‘casting an eye’ over work to full, thorough checking of all aspects and that there is a world of difference between these in effectiveness and effort involved. Some firms dislike routine checking because they feel it encourages a careless attitude among design engineers, who can come to rely on checkers to pick up their mistakes. Fortunately, or unfortunately (depending on your point of view), BSI has no policy on what standard of checking should be done - it requires only that something is done, the calculations or drawings ticked or initialled and records kept of any consequences.

Some will see this as welcome flexibility, allowing them to do what they think best; for the sceptic, it confirms worries that the BSI scheme amounts to little more than advertising and paperwork and has no real substance.
It would not be difficult for a cynical firm to generate all the paperwork QA requires, while doing nothing serious about the quality of its work - all that it would need would be more secretaries and more filing space. There is clearly an opening for some enterprising sort to produce a standard set of QA documents - a QA manual and various ready-to-use forms - to save firms the expense and bother of writing and introducing their own; all they would have to do would be to overprint with their name and address and their QA system would be ready to roll. Some might object that this would stop firms from working out their own ideas on improving quality, but isn’t this the whole idea of QA schemes?

Despite the many protestations to the contrary, it is pretty clear that QA increases a firm’s costs - both in increased administration costs and increased unproductive staff time (particularly for senior staff) - and there will inevitably be a temptation to economise by allocating the actual design work to more junior staff and reducing supervision, checking, etc., to the minimum that can be got away with. Then, as now, the real limit on quality will come not from QA procedures but from professional liability.

Improving quality is an important task for everyone, but that is not necessarily what ‘quality assurance’ is about. Viewed overall, QA is a very mixed bag of measures - some useful (such as record keeping by materials suppliers), some debatable (such as the ideas on internal company management and procedures) and some distasteful (such as the attempt to pressurise potential clients into using only QA-registered firms, claiming they are better than the rest). Yet while the debate rolls on, no one seems to be talking about the really important things for improving construction quality - having simple, clear lines of responsibility, taking care in the choice and supervision of staff for projects, emphasising personal responsibility and professionalism, making Codes of Practice practical and easy to use, ending the competition in fees which is encouraging all consultants to skimp on their work and, (lest we forget) improving the working conditions and training for the people on site who actually build our precious structures.

Clearly, some people in high places have decided that they know what is best for the building industry but somehow, somewhere they are sadly missing the point. The QA bandwagon is now rolling in our direction; are engineers going to do something about it, or are we just going to let it roll all over us?