

# CROSS

## Confidential Reporting on Structural Safety

### Newsletter No 7, July 2007

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## INTRODUCTION

This Newsletter is about the quality of submissions for Building Regulations checking and the views of Building Control officers. Key points from two long and detailed reports are:

- many submissions demonstrate inadequate understanding of basic structural issues
- poor co-ordination between designers, sub-contractors, and suppliers
- quality and standards have dropped
- Local Authority Building Control departments are under increasing financial and resource pressures
- there may be conflicts between the role of Approved Inspectors and Local Authorities
- risk analysis is being used as a way of deciding what should be checked
- submissions to Local Authority checking must not be a substitute for proper professional design and in house checking.

The Building Regulations in England and Wales are the responsibility of Communities and Local Government (CLG) who are currently considering the future of Building Control (The Future of Building Control - Communities and Local Government). Later this year there will be a consultation process and the views of engineers dealing with Building Control matters from all perspectives will be sought. This is an important development upon which safety issues, and the protection of the public, depend. Participation will give valuable feedback and influence change and details of the consultation will be given in a future Newsletter. As usual CROSS will welcome more confidential reports on these and other matters of concern.

Reports, which are in normal text below, are as written by reporters but edited to remove identification and sometimes to give clarification. The views of reporters are not changed. Comments in italics after each report are those from a panel of experts appointed by SCOSS (the Standing Committee on Structural Safety).

## BUILDING REGULATIONS CHECKING

A reporter's firm has been carrying out Building Regulations checks for 25 years, but it is only in the last six or seven years that concerns have arisen, some of which are described below.

**1. Inadequate co-ordination.** There were two instances of partial collapse during the construction of a 2 storey timber framed educational building. The Local Authority client nominated a timber frame sub-contractor for a Main Contractor Design & Build contract. The sub-contractor's design was not reviewed until there was a Building Regulations check by the reporter's firm. This revealed defects, some of which had been incorporated in the structure and had to be modified. The foundations, designed by another Engineer, also had defects due to no overall co-ordination. There were substantial financial consequences and the building should, according to the reporter, have been designed (or supervised) by one Engineer before going out to tender.

**2. Robustness/disproportionate collapse.** There have been, again according to the reporter, problems with single/two storey schools due to difficulties in interpretation of Building Regulations requirements. The reporter wants definitions of terms such "effective tie" and "robust", and design rules, illustrated with diagrams, for how framing should comply with Regulation A3. The reporter's firm has seen only one robust building in ten years (*presumably in terms of the designs submitted for checking*). On one school the steel roof sheeting (0.8mm thick) stabilizes the building. It rocked before the windows were put in but probably won't collapse due to ductility of steel – so does it comply with Part A of the Regulations? Difficult to disprove under BS 5950 - but the structure is not robust. Should a BS to cover "robustness" be drafted?

**3. Sub-contract design.** Considerable reliance, according to the reporter, is placed by Engineers on "guarantees" provided by timber frame suppliers and foundation contractors. No checks are carried out on suppliers' designs or specifications to see if their own design assumptions are met. In one case a strip foundation design for a

## NEWS ITEMS

### Impact on highway structure

Part of an elevated freeway in San Francisco collapsed at the beginning of May after a tanker carrying petrol crashed and ignited. It is believed that the fire weakened steel beams and led to the collapse of two 115m spans of roadway. The beams simply rested on the columns with no apparent ties to give continuity. The structure was reopened just 25 days after the incident, though one expert questioned the safety of the structure's four supporting piers which, it is said, were also damaged during the 1989 Loma Prieta earthquake. There have been a number of like incidents throughout the world.

### Death after freestanding wall collapse

A six year old boy died when badly built wall collapsed on him as he climbed over from his grandparents' garden to fetch his football in Colchester Essex. A chartered structural engineer told an inquest that the wall, which was 75mm (3 inches) wide, was far too thin. Verdict: accidental death. In Newsletter No 6 there were several reports of such incidents.

building several storeys high was "guaranteed" to have zero settlement on a stone consolidated site consisting of random fill. In another the design by a supplier for a timber half portal, was accepted by the Engineer without comment. This was despite the fact that it was pinned at foot and ridge, with large outward forces, and no allowance was made for these. An Engineer with responsibility for the whole design/co-ordination seems to have disappeared. The reporter wonders if it is left to Building Regulation checkers to do this essential job and where does self certification fit in?

**4. Inadequate design time.** One Engineer submitted drawings of a school hall with a brick panel 9m high x 7m wide with 100mm inner and outer leaves and a 75mm cavity. Even the designer's computer calculations submitted with the application said it would fail. Other panels were inadequately tied to the steel frame or were too large. Substantial remedial works were carried out, but why did the Engineer make these mistakes? Another Engineer on a shops/flats complex did the same – again resulting in major remedial works. The reporter's hunch is they simply did not have enough time, or probably the fees, to do the most simple of checks.

*CROSS comments: Regardless of the contractual situation all Engineers have a duty of care and there was a failure to exercise this in many of the quoted examples. It is recognized that not all submissions are made by Engineers but the CDM regulations require co-operation, co-ordination and information flow. As a basic step it is recommended that co-ordination issues are discussed between the Local Authority and the designer when possible to help both sides to appreciate the other's point of view. The objective is the same for both parties; to have safe buildings. The observations on robustness reflect a general and widespread lack of understanding about what is required to comply with Part A3 of the Building Regulations. It is a theme of concern to SCOSS, and the Institution of Structural Engineers plans to produce a report on the subject. A common thread through these points is that responsibility is divided. Case law has established that with sub-contracting, including design, there remains a responsibility to monitor the work of others. British Standards, design guides, and indeed common sense dictate that there has to be a single entity with overall responsibility for the design of safe structures. It is fortunate that there are firms like the reporter's to find and resolve problems although this should not have to be relied upon. Inadequate design time would not be an excuse for an Engineer faced with legal action over a collapse. SCOSS is concerned that there is a lack of competence and professionalism in the quality of submissions in parts of the industry, and that experienced Engineers are not engaged when they should be. (Report 033)*

## BUILDING REGULATIONS SUBMISSIONS

The following detailed report has been sent by a group of senior local government structural engineers. They refer to previous CROSS newsletters and in particular the reports relating to the poor quality of building regulation submissions and lack of checking resources.

**1. Quality and complexity of the structural calculations being submitted.** It has become apparent over the years that the standard of submissions being made has dropped significantly. This has put a burden on the checking engineers in undertaking a safety check. The reporters can verify the following increasing trends.

- Submissions with no drawings or details.
- Submissions with missing information, many submissions are to a client brief only, i.e. "it wasn't part of my brief to design that".
- Structural information from a variety of engineers or manufacturers with no co-ordination being undertaken of the design. No one engineer being responsible for overall stability of the building. The local authority checking engineer may provide the only opportunity to assess whether the independently designed elements will provide a building that is safe, and satisfies the requirements of the Building Regulations.
- Submissions made by an unidentified engineer, which makes it extremely difficult when trying to query the design or chase missing information.
- Increased use of structural design software.
- Trends towards design and build schemes that are contractor led, with restricted engineering involvement.
- Submissions from unqualified persons.

It has also become apparent over the years that the complexity of the submissions has become more involved. Reasons for this include:

- Geotechnical and foundation problems due to the development of more brown field sites.
- More submissions that are carried out on software packages. There are often problems with verifying the methodology used.

**NEWS ITEMS** *continued***New guide to temporary demountable structures from the Institution of Structural Engineers**

Temporary demountable structures play a vital role in events from pop concerts to race meetings. They are expected to feature heavily in the 2012 London Olympics, and were a key aspect of the winning bid. They can help to minimise capital expenditure, while also making events more sustainable, as facilities can be re-used. The publication in April of *Temporary demountable structures: Guidance on procurement, design and use* will assist in the preparation and planning currently underway for the Olympics. It has been prepared by an expert panel made up of representatives from the events and entertainments industry, Government, and the Institutions of Structural and of Civil Engineers.

There have been failures of temporary structures in the past so the guide has important safety implications. This third edition has been issued to all local authorities in the UK by Communities and Local Government who will endorse its use as the authoritative text on this subject

([www.istructe.org/news/article.asp?NID=306](http://www.istructe.org/news/article.asp?NID=306)). It provides guidance on all aspects of procurement, design, erection and use of temporary demountable structures for event organisers, venue owners, local authorities, contractors and suppliers, and competent persons who are responsible for their design. Further information on the guide, and details on how to procure it, is on:

[www.istructe.org/publications/pubdetails.asp?pid=138&bhcp=1](http://www.istructe.org/publications/pubdetails.asp?pid=138&bhcp=1)

Local Authorities are often the client at events using temporary demountable structures, as well as being the body responsible for public safety, and so need to carefully consider their role from two different viewpoints at such events. SCOSS is currently looking at safety issues concerning demountable temporary structures.

- Increased use of manufacturers' details and proprietary systems. Many checkers assume manufacturers' details to be correct. This is not always the case and the reporters often have cases where manufacturers have to amend their technical guidance. There are also instances of incorrect interpolations of manufacturers' details. A recent example of this was the misuse of a lintel. The lintel took the form of an inverted "T", in section and was originally shown in the manufacturer's details supporting a two leaf solid wall; with the web being restrained between the two leafs of masonry. The manufacturer was advising people that this was useable in cavity wall situation where the stem was unrestrained. An independent check undertaken on behalf of the manufacturer found in favour of the checking authority.
- Speed of response required for "design and build" schemes.
- Increased complexity of design codes with serious implications associated with the Eurocodes. Eurocodes are likely to increase problems during what is likely to be a lengthy transition period.
- Many domestic buildings fall outside the scope of the approved document A.

**2. The structural checking of submissions has come under a great deal of pressure.** The abolition of ACE (Association of Consulting Engineers) fee scales in favour of fee bidding has resulted in an over competitive market place, which has encouraged a general reduction in design standards especially in relation to smaller schemes. Originally the building control service was a subsidised service provided to members of the public. The implementation of self-financing made local authorities streamline their service. At this point a number of trends started to develop, including:

- The outsourcing of the structural checking service, with budget limits dictating the extent of the check.
- Risk assessment based checking, i.e. building control departments assessing which applications actually require a structural check.
- Building Control officers checking simple structural designs themselves.
- Adoption of standard details.

Building Control departments came under further pressure to reduce costs with the introduction of Approved Inspectors. There is a concern here as to the level of checking undertaken by "one man band" Approved Inspectors, especially regarding the structural elements of submissions. There are, say the reporters, numerous examples where the Local Authority has been called in by clients to deal with problems that have arisen on schemes run by Approved Inspectors. Two recent examples include timber rafters to a school that were under designed and deflected excessively under dead loading alone, and a gable wall that collapsed under wind loading due to no provisions for tying back to the structure.

According to the reporters Sir Peter Gershon's review of public sector efficiency (Spending Review 2004: Efficiency Review) is being viewed by many authorities as purely a cost saving exercise. Many of the degradations in service from self-financing are being compounded through the Gershon initiative. A number of authorities are now entering into joint working initiatives. This in principle is a good idea. However due to the way in which these business units are being established it would appear that the structural checking process is viewed as an overhead. This means that the checking process is now being governed on cost grounds alone with the level of service getting little if no consideration. The proposal of self-certification is a good concept, however many of the smaller designers are unlikely to sign up to this. Many of the reporters' clients have expressed the opinion that they rely on checking authorities as the only check on their designs. This is due to the fact that they undertake the work for a minimum fee and have little or no checking procedure internally.

**3. Results of the above pressures.** Outsourcing of structural checking services started with the advent of self-financing. This in principle is good as competition reduces costs but where does it stop? Recent enquires into this have revealed that two authorities are having their checks done for £5 per application by retired external consulting engineers. This equates to approximately 5 to 10 minutes a check. This time also includes administration time, dealing with feedbacks, chasing consultants for missing information and reporting if indeed this is being carried out. In order to keep costs down, practices are starting to use inexperienced staff for this element of work. There is a tendency for inexperienced staff to check what is put in front of them and not necessarily identify what is missing.

The reporters are aware of some authorities that have adopted a risk management approach, where calculations are not checked if they come from an engineer perceived as being competent or a well known engineering company, even though the "unchecked" design may have been carried out by a junior member of staff. The judgment for this is normally based on the presentation of the submission,

### What should be reported?

- lessons learned which will help others
- concerns which may require industry or regulatory action
- near misses
- trends

### Benefits

- unique reservoir of information
- better quality of design and construction
- possible reductions in deaths and injuries
- lower costs
- reduced concerns about liability

### Founder supporters

- Association for Consultancy and Engineering
- Construction Industry Council
- Constructing Excellence
- Department of Trade and Industry
- Health & Safety Executive
- Institution of Civil Engineers
- Institution of Structural Engineers
- Department of Communities and Local Government
- Office of Government Commerce
- Scottish Building Standards Agency

i.e. is it submitted on headed notepaper or do the applicants have letters after their name? If the application looks to be from a reputable company then no check is being undertaken. The Institution of Structural Engineers is trying to bring in self-certification but they may be unaware that it already exists in the form of uncontrolled internal risk management systems in some authorities.

The reporters are aware, that in some authorities, the smaller applications are being assessed by building inspectors, many of whom appear to be using simple software packages. Even though this may appear to be an acceptable compromise there are concerns over the use of this process by staff whose first discipline is not structural engineering. A culture of checking the maths rather than the concept seems to be evolving.

The reporters have received numerous examples of abuse of simple programs, which include:

- No understanding of effective lengths. Due to this lack of understanding many adopt a worst case scenario, which is resulting in clients having overly expensive solutions.
- An inability to assess load intensities, or even understand the redistribution of loads from other areas within the construction.
- Beams in pairs are designed to take equal share of the load under a cavity wall with no understanding that normally the inner leaf is more heavily loaded.
- Total misuse of programs for design of portals.

Building Inspectors have, in the opinion of the reporters, a fundamental inability to review local/overall stability when walls are removed in buildings. Current trends in construction leave many buildings open to this risk. Significant numbers of properties fall outside the scope of approved document A. Some authorities known to the reporters are currently being forced to consider passing over between 33% and 65% of their structural workload from engineers to building inspectors to check. A wider investigation of certain authorities indicates that the percentage of applications that have a structural check carried out on them ranges from between 19% and 57%. When considering the current short supply of building inspectors and the increased complexity of other parts of the Building Regulations, the reporters have to question the logic in loading them up with additional responsibilities that are not their primary function.

**4. Conclusions.** The complexity of submissions has increased and the quality/resources available for checking have decreased substantially over recent years. This is now giving many of those involved with the checking process serious concerns over the adequacy of current service delivery. The quality of submissions is reducing and many designs are now undertaken without the benefit of the engineer even undertaking a site visit. Simple errors regarding the design are commonplace and the Local Authority check can be the only process where designs from several independent sources are co-coordinated. There is obviously a wide variation in the level of service being offered. This variation is not only between local government inspectors and private approved inspectors but also between various local authorities.

The reporters feel that in many instances, inadequate checking is being undertaken. This is unlikely to result in failures of buildings in the short term due to the current factors of safety associated with building design. However a trend of reducing factors of safety could result in a disproportionate number of incidents once the design loads are achieved during a period of excessive weather or unforeseen loading conditions.

Most of the engineers who read the CROSS Newsletters or *The Structural Engineer* are professional engineers and would not be affected by many of the factors discussed above. However the reporters are seeing a disconcerting number of poorly designed and incomplete submissions. Many recent designs are from people with limited or no engineering background. The reporters believe that we now seem to be living in a society of "DIY developers" and "low cost engineering" where the importance of a rigorous checking regime is both needed and expected by the general public.

*CROSS comments: 1. Quality of calculations. This is a disappointing catalogue of experiences from a group of experienced engineers. Despite HSE categorising structural engineering as a 'safety critical' activity, there is no restriction on who can make a submission under Part A of the Building Regulations. Without detailed drawings, it is almost impossible for Building Control to spot the problems before construction. At the domestic level, drawings of existing conditions are unfortunately very rare. Overall stability must be the responsibility of a single body within the design process although a particular difficulty may be that it is not known who has prepared the calculations. Perhaps there should be guidance to Local Authorities on*

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who is permitted to make structural submissions as recommended in the 16<sup>th</sup> biennial SCOSS report which was published this month (at [www.scoss.org.uk](http://www.scoss.org.uk)).

**2. Pressure on checking.** Cost cutting has had impacts throughout the industry but outsourcing does not necessarily lead to reduced quality of checking. There is no doubt that a degree of risk assessment based on reputation is commonplace but there should always be independent checks. It is recognised that there is a potentially dangerous trend for non-engineers to use simple, and cheap, software for designs. There have been reports from other Building Control officers who say they have had submissions from architects and from builders with no structural knowledge, attempting to use such packages with poor results. Some Building Control surveyors are more than capable of checking calculations but it is important to recognise the level of expertise needed for a particular case. Part E of the Building Regulations 'Resistance to the passage of sound' encourages the use of a family of standard details to ensure compliance, and may be a way forward for other Parts of the Regulations in relation to simple structures to avoid some of the problems.

It is difficult to see how a Local Authority could consider checking is an "overhead" since this is one of their duties. The introduction of joint working between Authorities could make it easier to employ engineers directly, but the success of such mechanisms depends upon management to assess local demands. A scheme for Certification of Design (Building Structure) has been adopted in Scotland ([Structural Engineers Registration Ltd](http://www.structuralengineersregistration.co.uk)), and may be considered for England and Wales, but there is no timetable and consultation has yet to take place. The concept of having work done by "Approved Bodies" is used by Communities and Local Government for satisfying other parts of the Building Regulations, and could be extended to some form of certification if the industry were convinced it would help to improve quality and reduce pressure on checking.

**3. Results of pressure.** The issues mentioned can all lead to a reduction in safety and are amongst the difficulties encountered with cost cutting. If a firm is known to have quality management procedures in place that comply with ISO 9000, or there is a good knowledge of the firm, this may affect the degree of external checking considered to be necessary. The message from the reporters is that more, and better, resources are necessary firstly to improve the quality of design and secondly to have enough engineers within Local Authorities.

**4. Conclusions.** Compliance with the Building Regulations has an important role in providing structural safety. SCOSS will be pursuing this issue and has covered some aspects in the 16th Biennial Report. As mentioned previously Communities and Local Government will be consulting widely later in 2007 on possible changes to the Regulatory process and these concerns will be brought to their attention. CROSS would welcome more reports on this topic in order to demonstrate the serious nature of the problem. (Report 065)

## LOCAL AUTHORITIES AND APPROVED INSPECTORS

A reporter is very concerned that the system of Building Control where there is competition between Local Authorities and Approved Inspectors, has produced a situation where the level of independent inspection has fallen dramatically. Building control has served well over the years and has contributed to preventing structural failures and increased the quality of construction. From personal experience, the reporter can cite examples where the independent check has picked up potentially dangerous design and construction situations.

The level of competition at present means that fees for building control are much lower than in the past, certainly for the large commercial developments with which the reporter is involved. This is due to the fact that Approved Inspectors undercut the Local Authority charges by huge amounts. The Local Authority must then reduce fees to be able to win any work, as the clients or their representatives seek to appoint the cheapest building control body without regard to the service provided. This means that, as the Local Authority must recover its costs, the level of inspection has to go down. The scope of the Regulations is also expanding, putting greater pressure on resources.

The reporter would be careful to comment on the level of inspection and checking provided by Approved Inspectors, but as commercial entities making a profit, they must logically be under the same if not greater pressure to reduce the number of inspections. For the majority of projects, less frequent Building Control inspections would not necessarily be a problem, but there are a number where the level of site inspection by main contractors is nil, and combined with a reluctance to employ resident engineers the reporter perceives that some projects get very little independent checking.

*CROSS comments:* While competition has generally improved customer service, there may be instances where this has led to deficiencies and errors. In the last few years, there is an impression that many developers pay more attention to getting the paper work in order rather than being interested in the inspection regime. Possible conflict between Local Authorities and Approved Inspectors is a serious issue that needs to be reviewed as part of the current debate in the industry. The responsibilities in law of checkers, whether from Local Authorities or Approved Inspectors, should be clarified. CROSS would be pleased to have other data about the relationships between Local Authorities and Approved Inspectors on structural issues. (Report 067)

## EFFECTIVE LENGTHS OF LOAD-BEARING WALLS

A reporter is aware of several single and two storey school extensions that have been built and passed by Building Control but which have long load-bearing walls that do not comply with the limitations on effective length. The 'Manual for the design of plain masonry in buildings (2005)', published by the Institution of Structural Engineers, indicates that the effective length determines the design even if the effective height requirement is met. If nothing else some clarification would help. Pressures on cost, light and space mean robustness is being compromised.

*CROSS comments:* These are cases of the structural engineer failing to design to accepted standards. If the design is not following a 'deemed to satisfy' approach, the onus is on the designer to demonstrate the adequacy of the design. The design of apparently simple brickwork and blockwork elements may have in fact been carried out by those who are not familiar with relevant guidance, and this is of particular concern where schools are involved. Indeed it is only comparatively recently that schools have come within the scope of the Building Regulations and Workplace Regulations and more compliance issues may be expected from designers who are not familiar with the Regulations. (Report 056)

## LOADING ON BALCONIES

A reporter wrote on behalf of a professional committee about the conversion of an old industrial building into a series of dwellings which include new external balconies. Apparently there has been disagreement between the parties responsible for the design and construction of the development regarding the safety of the balconies. As a result a loading limit has been imposed upon them. It is not clear to the professional committee what action, if any, is being taken to determine whether the balconies fully comply with the Building Regulations, or if they do not, what remedial action is being either planned or implemented. This situation seems to the committee to be far from satisfactory. However, due to the privileged nature of the information that has come into its possession it is not able to directly address the matter itself and is therefore reporting the matter to CROSS.

*CROSS comments:* There should not be loading restrictions on a normal building. Balconies can cause problems (see CROSS Newsletter No 5 January 07) and, as cantilevers, have to be competently designed and constructed. As in any development there has to be clarity on design responsibilities particularly the interfaces between the parties and the safety of the ultimate users, in this case the householders, should not be prejudiced. If the parties responsible for design and construction cannot agree a way forward the appropriate action is for the client to have the work done, and Building Regulation approval obtained, and for costs to be recovered costs through the courts or by adjudication. If such a balcony were to collapse there could be criminal proceedings under the Building Act (1984). (Report 052)

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### DATES FOR THE PUBLICATION OF CROSS NEWSLETTERS

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