

## SCOSS ALERT

February 2017

### Inquiry into the construction of Edinburgh Schools

#### BACKGROUND

This Alert is based upon the *Report of the Independent Inquiry into the Construction of Edinburgh Schools February 2017*<sup>[1]</sup>. It deals with the aftermath of the collapse of part the outer skin of a cavity wall at Oxgangs Primary School Edinburgh on 29th January 2016 in high winds. Nine tonnes of masonry fell onto an area used by pupils and other pedestrians but fortunately there was nobody in the vicinity at the time. As is often the case with structural failures the margin between a near miss and a catastrophe is wafer thin. This wide ranging and comprehensive Report concerns investigations into defects in the construction of the external walls of 16 other schools in Edinburgh, resulting in the enforced closure of all 17 schools for a period of several months. The buildings had been procured as part of the same Public Private Partnership contract between 2000 and 2005. The Inquiry wished to emphasise the importance of the subject matter and the need for the matters raised by it to be properly addressed by the construction industry, by public sector and other clients, by regulatory authorities, and by actions of Governments as necessary. This Alert however deals with only with structural safety aspects. A fundamental aspect, as illustrated by many previous failures, is for the Design Team to know that what they thought was being built was actually built.

The speed with which the comprehensive and far-reaching Inquiry Report has been produced is admirable.

#### WHO SHOULD READ THIS ALERT?

This Alert is aimed at both public and private clients who own and commission buildings, designers, including architects and structural engineers, main contractors, sub-contractors, especially brickwork sub-contractors, building control officers and approved inspectors. It applies to buildings of all types; particularly those constructed in recent times with external brick panel walls.



#### FINDINGS OF THE REPORT

It is the view of the Inquiry that the primary cause of the collapse of the wall at Oxgangs school was poor quality construction in the building of the wall which failed to achieve the required minimum embedment of 50mm for the wall ties, particularly in the outer leaf of the cavity wall. The poor quality relates to all three of the following aspects:

- the direct laying of the bricks and the positioning of the wall ties;
- the direct supervision of the laying of the bricks and the positioning of the wall ties; and
- the quality assurance processes used by the sub-contractor and main contractor to confirm the quality of the construction of the walls.

If the wall had been designed and built to the required appropriate standard it would have been able to withstand the level of wind loading to which it was subjected.

Following the collapse visual surveys of the external walls of all 17 schools were made without reports of any visible signs that would suggest defective construction. The only time that defects could and should have been found was when the schools were being constructed through a process of proper supervision and

inspection. There is much discussion on the degree of supervision of the work and the Report says that while the presence of Clerks of Works cannot guarantee the absence of defects there is no doubt in the view of the Inquiry that the use of experienced Clerks of Works (or Resident Engineers) results in a much greater likelihood of defective work being identified. Evidence given to the Inquiry also suggested that the presence of a Clerk of Works or Resident Engineer can change the mindset of those working on sites, and can have a positive impact on the way they approach their work.

It would, however, continue the Report, be naive to suggest that this is a problem only relating to the construction of schools and that contractors apply a better standard of quality assurance on other building types. If these defects are present in school buildings, there is also a likelihood that they are present with similar frequency in other buildings that contain large masonry panels or where masonry panels are required to be tied back to a structural frame. The Report says that the procurers of buildings need to consider whether the drive for faster, lower cost construction may be being achieved to the detriment of its quality and safety.

### **DEFECTS FOUND**

Defects found in the first school were variable cavity widths, lack of minimum 50mm embedment of ties in the mortar joints, and lack of consistent levels between the inner blockwork leaf and the outer brickwork leaf. Investigations of the other schools using intrusive techniques found similar defects coupled with an absence of wind posts, lack of head restraints to steel frames, and in some cases a lack of specified bed joint reinforcement. Part of the evidence provided to the Inquiry was information that the inner blockwork leaves of cavity walls had been built prior to the construction of the outer leaves. The size of the problem was such that approximately 440 heavy steel wind posts were required to be retro-installed across the 17 schools. To bring the walls back to the intended strength remedial works were undertaken by retro-fitting ties through both leaves using specialist sub-contractors. A significant number of head and corner restraints also had to be retro-fitted.

Quite separately a significant number of breaches of fire-stopping were revealed across all 17 projects ranging from minor gaps around pipes and cables to some larger holes or gaps in what were described as fire compartmentation. Most of the reported breaches occurred in the roof spaces of the schools.

It is the view of this Inquiry that the financing method per se did not have a direct relationship with the presence of defective aspects of the construction in the Edinburgh schools. There is no reason why properly managed privately financed public sector buildings, using best practice approaches, should not deliver buildings constructed to a high standard. However, the Inquiry was concerned that some elements of best practice associated with more traditional models of procurement failed to be consistently incorporated into the implementation of the projects.

### **DOCUMENTATION**

There was much evidence provided to the Inquiry as to the significant additional complexity in dealing with the issues due to the absence of 'as-constructed' drawings. There were also significant differences between the design details on the limited number of 'final issue construction drawings' that were eventually made available to the Inquiry and what had been constructed.

The Inquiry found that insufficient attention was paid to the accurate documenting, storage and maintenance of 'as-constructed' drawings and related documents. Quite separately consideration is being given by SCOSS to the often-neglected requirements to comply with CDM Regulations for supplying documentation to owners.

### **QUALITY**

It is the view of the Inquiry that the quality management systems, as implemented on the projects, were insufficient to prevent the defective construction that could have resulted in fatalities to children. Accordingly, systems must be employed by contractors that can provide the level of assurance required as to the quality of all aspects of the construction, especially in relation to safety related elements.

There was widespread failure to incorporate designed elements that were shown on engineers' drawings by a range of different contractors and subcontractors, it is (says the Report) appropriate that the construction industry reviews how effectively information is produced, coordinated, presented and communicated to

contractors and to tradesmen on site. The industry also needs to re-examine its approach to the recruitment, training, appointment, means of remuneration, vetting, supervision and quality assurance of bricklayers.

### **SUPERVISION AND INSPECTION**

With the increasing adoption over recent years by the public sector of other models of procurement under which the design team is employed, and their terms of employment determined, by the building contractors, the level of independent scrutiny of construction has been significantly reduced. (A point often made in CROSS reports). All the architects, engineers, building control officers and other professional representatives who gave evidence to the Inquiry, expressed concern as to the impact of the increasing lack of independent scrutiny on the quality of construction in the industry.

A strongly shared view, expressed by many witnesses, was that the reduced requirement for visits by the design team to site was now an increasingly common feature in the conditions of appointment set by the contractors employing them. Many saw this as preventing designers playing an effective and necessary role in ensuring that the design intent behind their drawings and specifications is understood and implemented on site. The same point has often been made over the last 10 years in reports to CROSS <sup>[2]</sup>. It was stated by many witnesses that it was now much rarer for public sector bodies (or others) to engage Clerks of Work (or Resident Engineers) and this was considered to be a real risk to quality and safety.

### **COMMUNICATING THE DESIGN INTENT - STRUCTURAL DETAILS AND APPROVALS**

It is the structural engineer who is responsible for designing the structure of a building to consider the strength and stability of masonry wall panels to ensure that they can withstand relevant wind loads. Wall types and thicknesses, panel sizes, edge restraints, wind posts, movement joints, and bed reinforcement must be calculated and documented. The Inquiry said that all relevant structural information, details and specifications impacting on the structural integrity of the building should be included on the structural engineers' drawings in a form which is fully integrated with the architectural design. It also emerged, in the evidence to the Inquiry, that the lack of accessibility by bricklayers on site to this information presented in a practical and manageable form was viewed by many as potentially contributing to quality issues. Many of these details, including wall ties, are fixings of one sort or another and it is significant that the biggest single source of concerns and failures reported to CROSS is 'fixings'. Designers and constructors must become more aware of the safety critical nature of such items.

The part played by Local Authority building control was considered by the Inquiry. It is not appropriate for Building Standards departments to be expected to undertake the type and level of detailed inspection that is necessary to identify the type of defects found, but consideration should be given to requiring better practice methods of the construction industry that would in turn provide Buildings Standards with the proper level of assurance in these risk areas.

### **DEFECTIVE CONSTRUCTION MORE WIDESPREAD WITHIN THE INDUSTRY**

All Local Authorities in Scotland were asked if they had experienced similar issues in the past and several cases were identified of school walls that had collapsed. This information had apparently not previously been registered in a central source. The fact that sub-standard, unacceptable and potentially dangerous quality of construction failed to be identified and rectified on many different sites would suggest that the standard of wall construction in the industry may be a more widespread problem. There should be a public duty on such organisations to openly share with each other and the construction industry, information on recurring defects of a type, which unless addressed by the construction industry and regulatory bodies, may present an on-going risk to the public.

### **RECOMMENDATIONS FROM THE REPORT**

Many of the recommendations relate to factors which, when combined over time, have helped to create circumstances in the procurement of public buildings, such that the collapse of the wall at Oxfangs appears to be a symptom of a broader problem. Although the recommendations refer to public works they should also be considered as relevant for private developments. The following are edited extracts from the much larger list in the Inquiry Report and many of them reflect experiences previously reported to CROSS.

1. A public body should ensure that it has in place the requisite and appropriate resources to enable it to act as an 'Intelligent (informed) Customer'.
2. Public sector clients should engage individuals or organisations with the necessary professional expertise to undertake on their behalf an appropriate level of ongoing inspection.
3. The use of Resident Architects, Resident Engineers and Clerks of Works has dramatically reduced over recent years. This deficiency must be recognised and addressed.
4. Public sector clients (and others) should require that tenders include a full description of the proposed scope of design team services, including any proposed role in the inspection of the works on site. This should be an important factor in the assessment.
5. The production, retention and updating of accurate construction and operational information and related documentation should be regarded as a fundamental requirement. Contractors should be required to certify that the 'as-built' documentation is an accurate record.
6. It is critical that there is effective communication of essential design information in an accessible form to tradesmen such as bricklayers working on site.
7. Structural engineers should describe in their documentation and drawings the approach adopted in terms of the reliance on the inclusion of bed joint reinforcement, wall head and lateral restraints, and wind posts. Information on the construction of external cavity walls should be provided by the structural engineering consultants. (Particularly when they are non-loadbearing.)
8. Contractors should ensure that any amendments to the structural design of buildings should only be implemented after checks by the structural engineer and any changes to the approved design should be documented.
9. The construction industry should carefully review the practice of building the leaves of cavity walls separately and consider alternative methods such as the use of internal framing systems.
10. It is recommended that the construction industry should seek to introduce standardised best practice methods in relation to the requirements of the related quality assurance processes.
11. It is recommended that quality assurance processes on site are such that they prevent the closure of walls before proper inspection and sign-off have confirmed the quality and completeness of the work.
12. It is recommended that the construction industry should re-examine its approach to recruitment, training, selection and appointment of brick-laying subcontractors, and bricklayers.
13. It is recommended that consideration be given to independent in-depth inspection by a suitably qualified person or specialist company, to certify that fire-stopping has been completed in accordance with the relevant building standards.
14. There is a need for Government and the construction industry to consider the introduction of methods that would provide Buildings Standards with the required level of assurance in risk areas.
15. It is recommended that there should be a formal requirement on public bodies to make automatic disclosure to a central source of information on building failures, particularly in relation to building failures that bring with them potential risks to the safety of building users.
16. The collation and dissemination of information relating to matters of structural concern is a vital element of achieving safe structures. The Confidential Reporting on Structural Safety (CROSS) scheme <sup>[3]</sup> facilitates this process and should be used more widely.

17. Other clients of recently constructed buildings of a similar scale and form of construction to the Edinburgh schools, if concerned that their buildings may contain similar defects, may wish to adopt a proportionate and structured risk-based approach to any investigation process they may feel necessary. This is specifically regarding the issues identified on the schools i.e. wall tie embedment and the provision of appropriate restraints to masonry panels. It should be noted that, as found by the Inquiry, defects cannot generally be identified by external visual examination.

SCOSS also suggest that Client Organisations could revisit the robustness of their technical assurance regimes to provide additional independent assurance that the requirements of specifications for workmanship and materials, drawings, inspections and test plans and other design documents, are being complied with.

### ACKNOWLEDGEMENT

Thanks are due to the Inquiry for permission to publish parts of their Report.

### REFERENCES

1. [Report of the Independent Inquiry into the Construction of Edinburgh Schools](#) February 2017
2. [Structural-Safety.org](#)
3. [CROSS reporting](#)

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Web site [www.structural-safety.org](http://www.structural-safety.org)

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