Structures Expert Panel

Submission of Structural Engineering Data for Approval under Part A[1] of the Building Regulations

Maintaining an Adequate Standard

1. Introduction

1.1 There has been concern expressed by various Building Control Authorities, over many years, that the quality and sufficiency of Building Regulation Approval submissions, under Part A Structure [1], is often below the standard to be reasonably expected. This issue was also raised by SCOSS in 2007 [2] when it stated

> *2.6 There is strong anecdotal and direct evidence to suggest that the current situation is undermining the importance of structural engineering to the health, safety and welfare of those in and around buildings, and is creating a situation where there is an 'accident waiting to happen'.*

1.2 It has also been discussed by the Association of Structural Engineers of London Boroughs (ASELB) which issued a guidance note in 2011 [3].

1.3 This note provides background and expectation with regard to the standard of submission made under the Building Regulations to Building Control Bodies.

2. Background

2.1 Many submissions are of poor quality and lack engineering judgement, frequently exampled by a failure to:

i. Identify which designer is responsible for which aspect of the building and the precise delineation,
ii. Identify who is responsible for the overall robustness of the structure, (especially for trussed rafter roofs, and reinforced concrete (including precast) work)

[1] But equally applicable to Scotland, Northern Ireland and Wales.

iii. Identify the effects of the works on other structures
iv. Implement an adequate check, prior to submission.
v. Identify the key assumptions and information such as British Standards adopted and disproportionate collapse statements
vi. Clear indication when the design/ detailing/ specification does not complying with the relevant published and recognised Standards (e.g. contractors who use their own 'Standards' which are unique to them!).

2.2 This is often exacerbated by:

i the nature of contemporary structural calculations which are mostly computer generated
ii the split of design, detailing and specification responsibility between a number of parties, whereby some are not appointed until late in the project, and then by contractors with no direct contractual linkage with the client consultant designers or client itself.

2.3 However, it is incumbent on the structural engineer to provide clarity and sufficient information to allow the Building Control Body to judge whether the submission complies with Part A, without unnecessary investigation on the latter's part. No matter which design codes are used, the assumption inherent within them is that the user is competent.

2.4 There are a number of reasons why submissions should meet a professional standard, including:

- General duty of care
- Compliance with Institution Code of Conduct e.g. having regard to safety of others.
- Statutory duty to manage risk
- An implicit obligation to use published and recognised standards where such standards exist, e.g. British Standards, recognised industry guidance).

3. Components of an Acceptable Submission

3.1 Although there is no explicit requirement in the Building Act, Regulations or Approved Document A (AD A) relating to presentational standard or content, it is clearly implicit and an obligation on any professional engineer to have regard to this aspect (as noted in S2 above).

3.2 Submissions made in order to obtain building regulation approval need to convey adequate information, including, typically:

Base information

i. Geotechnical data and test results relevant to the building design, where applicable.

Codes of Practice, Guides and the like

ii. All of the design codes of practice applicable to the design and construction (not a selective few).
iii. Categorisations e.g. CC2,

The Design Calculations

i. Design assumptions
ii. Critical construction issues e.g. instability
iii. Critical interaction with other disciplines

and should:

iv. Justify structures as structurally stable and complete (even if further elements of the project are yet to be submitted). A check cannot be undertaken on an incomplete structure.
v. Indicate the significant residual risks, of relevance to contractors or other designers, relating to the construction phase[2]
vi. Indicate key information for any 'following' designer.

The Structural Drawings

vii. Include sufficient quantities of dimensioned co-ordinated drawings and details to allow a proper understanding of the submission.

Limits to application

iv. The structural limits of the submission
v. Parties responsible for other elements of design (where known)[1]
vi. Party responsible for overall robustness (this should always be made known to the designer)

Software

i. The ubiquitous use of software has made the review process difficult. Many submissions are made with an abundance of output but without any explanation as to the assumptions made, limitations, defaults and the like. Software is often misused. Hence it is important to state explicitly what has been used, details of the model, and the key controlling assumptions.

[2] This should also be done for the operation, maintenance and demolition phases but these are not required for Building Regulations Approval.
[3] Where other parties are not known, and their design could influence the assumptions made, or the other's design could affect the design being submitted, it is essential, and an obligation for the designer, to pass on details of assumptions made and significant residual risks.

4. Essential Competency Standards

Individuals

4.1 Part A is concerned with structural safety. The analysis, design and checking of structures to ensure structural safety requires competent input. There are examples where even the simplest of designs-even using standard details- can lead to problems if the wider implications are not understood.

4.2 Ideally those undertaking this role should be members of an appropriate professional institution e.g. ICE or IStructE with associated relevant CPD. Alternatively, they should be satisfied that they have appropriate competence in respect of education, training and experience to deliver a competent design, with appropriate supervision.

4.3 In most cases it is not appropriate for someone without this background to be involved, regardless of the scale of the work. British Standards assume that the user is competent.

Corporate

4.4 Design organisations need to exhibit corporate competence so as to provide the necessary support for employees.

5. Essential Information

5.1 In order that submissions may be adequately assessed, it is suggested that all submissions should schedule the data Statement Sets on a frontispiece to the calculations:

Statement Set 1: Limits of Submission

	Description	Comment
1	Describe the physical limits of the submission if less the whole structural project.	
2	If less than the whole project, schedule those parties dealing with the balance	
3	What elements are to be contractor designed?	
4	If The Party Wall etc. Act applies to any part of the works, name the Party Wall Surveyor(s).	Note that the Act applies to other elements than the party walls themselves, e.g. retaining walls on the line of boundaries).

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Statement Set 2: Technical Background

	Description	Comment
1	Is the submission made on a 'deemed to satisfy' basis ? If only in part, describe the boundary.	
2	If yes to Q1, list the structural design codes with which it complies:	This is particularly important whilst both Eurocodes and withdrawn codes eg BS8110 are still used.
2a	If Yes to Q1, and the submission utilises standard details from Approved Document A, confirm that the structure satisfies any limitations on the use of these details.	
2b	If no to Q1, explain the basis of design	This requires sufficient detail to allow others to understand the structural principles used and the means by which stability is achieved.
3	Indicate fire resistance requirements	
4	Indicate key loading (action)	To include floor loads and wind
5	Into what class has the structure been placed for purposes of disproportionate collapse design (Table 11 of AD-A) If the structure is in a number of classes describe the division.	
5a	Describe: i) how the class has been arrived at. This is particularly important with existing structures which are subject to a material change. ii) the measures taken to guard against progressive collapse. The Approved Document allows a number of structural options.	If the structure: i. is not listed in Table 11 explain the rationale behind the choice of Class ii is Class 3, see also Q4
6	If Class 3 (or CC3) include the full results of the systematic risk assessment and details of method used.	This should follow the advice given in the IStructE guide, unless an adequate alternative is demonstrated.
7	Describe (illustrating as required to give sufficient clarity) the load-path to the foundations and how lateral stability is achieved. This should deal with both the final and key interim construction stages.	

8	Confirm that: i) the structure may be safely built and, ii) that suitable information in this regard will be made available to the contractor.	A requirement of the CDM Regulations. In all but simple cases this should include a description/diagram of the assumed construction sequence of the key members, illustrating any issues relating to interim stability (see Q4).
9	Name the organisation, or individual, which has overall responsibility for the stability of the structure as required by BS 8110, 5950, 6828 as appropriate.	See Clause 1.02 (BS5950); Foreword (BS8110), Clause 1 (BS5628) and Clause 1.3 (EN 1990)
10	Schedule the software used, and for what purpose; confirm that its application and limitations are understood and that the results have been verified.	

6. Conclusions and Recommendations

6.1 The Building Regulations approval process should be as simple and open as possible, consistent with safeguarding the health, safety and welfare of those in and around buildings.

However it also needs to recognise that:

- structural engineering is safety-critical
- submissions must be made by competent persons
- submissions need to make clear the fundamental assumptions on which they are formulated.

References	
1	This relates to England but similar situations occur in other UK jurisdictions
2	16th SCOSS Biennial Report 2007 Appendix C
3	ASELB guidance note 2011

Appendix A: Examples of Poor Practice	
1	Architect's drawings are seldom co-ordinated and updated with engineer's drawings and calculations.
2	Quality of drawings is poor. They often omit essential information such as dimensions, direction of floor spans, grid lines and the history of revisions and changes. Sections and elevations are not indicated on the plans.
3	Submission of calculations. Index sheets are often not supplied and pages are un-numbered or an obscure numbering system adopted, especially where computer calculations are used. There is no clear load build-up of construction materials, only total loads, and assumptions made by the engineer are frequently omitted.
4	Calculations are seldom checked in-house or signed by a checking engineer.
5	Computer output obviously not been checked – just accepted. Examples of mistakes not picked up include; (a) deflection output found to be based on restraint dimension, not span, (b) 500 x 50 floor joist in lieu of 150 x 50 and span input of 3mm in lieu of 3m.
6	Structural information such as beam reactions, bending moments and axial forces are rarely shown on drawings and calculations. This is a concern when connection details usually are not supplied by the designer and left to the contractor.
7	Error in foundation design relating to a 7-storey residential building. The design had been based on a central reinforced concrete core with steelwork attached. Overturning moments due to wind/sway had been ignored. After communicating Building Control findings there was no acknowledgement from the designer until it was advised that the newly built structure was being underpinned 4 weeks later.
8	Specification of materials are not always stated, giving rise to the wrong materials being used on site, such as steel quality rarely given by the engineer, giving rise to brittle fracture.
9	Loft conversions are often designed by persons using computer software sizing individual structural members only without regard to overall stability or wind loading.

10	Two number 152 x 152 universal columns spliced together using 4 number M24 diameter HSFG bolts in end plates. This detail is unbuildable due to the size and constraints of the dimensions of the steel section and bolts together with the difficulty of using an impact/power wrench.