

To: Building Industry Authority

From: Richard Martin

Approved
for submission
to the Authority: John Ryan

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JOHN SCARRY OPEN LETTER – UPDATE ON PROGRESS

Purpose

This paper updates the Authority on the recommendations of the final report from the IPENZ Structural Engineering Practice Review and the final Sinclair Knight Merz (SKM) report on issues raised by the John Scarry Open Letter. It also outlines the resulting BIA actions. In particular, this report:

1. Summarises the original concerns raised by John Scarry,
2. Outlines the final IPENZ recommendations and how the BIA intends to respond,
3. Outlines the final conclusions of the SKM report and the BIA's resulting work plan, and
4. Provides a summary outline of longer term BIA involvement in this area.

Background

Towards the end of last year, John Scarry, a Structural Engineer operating independently of the major consultancies, circulated an open letter to the industry and its professional bodies, and to government, raising a number of issues relating to the structural engineering profession.

Mr Scarry believes standards of engineering practice in New Zealand are falling and voiced concerns about design and construction practices and their effects on building safety.

His concerns related to a broad range of design and construction deficiencies in commercial buildings rather than housing. These shortfalls would be most evident during earthquake loading.

In response to the Scarry letter, the BIA worked with the Institution of Professional Engineers (IPENZ) to address the key issues by way of two complementary reviews.

IPENZ's review focuses on engineering practice issues. They established a Structural Task Force to address the engineering practice concerns identified in the Scarry paper. This is now complete and the Taskforce report is attached to this report. I support the recommendations and this paper comments on them in more detail.

The BIA's review, as the regulator, focuses on technical issues relating to building safety and compliance and was undertaken by an independent engineering consultancy Sinclair Knight Merz (SKM). This study has now been completed and will be summarised in more detail, along with BIA actions in response, later in this paper.

Both reports endorse the original draft conclusions presented to the Minister in June. However, with the progression of work on the Building Bill since June, the IPENZ report is able to explore more fully the likely impact of the Bill on the deficiencies in building practise highlighted by John Scarry.

The IPENZ Report

The IPENZ Taskforce has presented seven key recommendations aimed at dealing with systemic failures in the regulatory environment of the building industry. Some of these recommendations impact directly on the functions of the BIA. The Taskforce remains of the view that unacceptable variations in standards of practice do exist. Their recommendations highlight the need for:

1. More comprehensive standards and codes of practice, controlled and commissioned by the BIA.
2. Professional involvement through all stages of project delivery to ensure continuity and thus fewer errors during construction stages.
3. Systematic recognition of competent Structural Engineers.
4. Expanded technical leadership role for the central regulator.
5. Improved and more consistent consent and design checking processes.
6. Greater responsibility for building owners to engage qualified professionals.
7. Better evaluation and certification of new untested materials before they are introduced into the market.

BIA RESPONSE

The BIA supports these recommendations and comments on them in more detail as follows:

1. *More comprehensive standards and codes of practice, controlled and commissioned by the BIA*
2. We believe that the targeted funding received from commercial interests by Standards NZ (SNZ) does not always generate the breadth of standards required in the structural area. The BIA has already stepped up its involvement with (and funding of) the work by SNZ on structural engineering standards. As an example, the BIA is currently looking at the overall effectiveness of standards for high tensile reinforcing steel after recent failures resulting from poor handling of grade 500E steel.

Until 1985, much of this investment in engineering standards and codes of practice was made by the Ministry of Works. The BIA is not currently resourced for this level of involvement, but is currently looking at:

- The degree to which current resources and business plans will meet the need for a wider range of standards and codes of practice.
- What additional resources would be necessary to fully address the IPENZ recommendation

We note the IPENZ support for the use of building levy funds to develop these standards and codes of practice, and endorse this recommendation.

IPENZ are concerned that the relevant requirements in the Building Bill on the Chief Executive are too weak and that there should be a stronger requirement on the Chief Executive to maintain a sufficiently comprehensive set of standards. We believe that the role of the BIA already adequately allows for such work and that there is no need to further enshrine it in the Bill. We also note that the BIA intends to develop a broader range of guidance information and this is discussed later in this report. This guidance material will also fill the need for more extensive codes of practice.

3. *Professional involvement through all stages of project delivery to ensure continuity and thus fewer errors during construction stages.*
4. We agree that the Practitioner Licensing regime specified in the Bill will largely meet this need. It will not necessarily mean continuity of the same professional involvement, but will ensure that as-built details are self-certified by a competent professional.
5. *Systematic recognition of competent Structural Engineers.*
6. Careful design of the licensed practitioner regime and the CPEng registration within it will ensure that a rigorous competency assessment

regime is put in place. The important role of TLAs and Certifiers in maintaining these standards will be emphasised through the BIA audits of TLAs, and will be communicated to TLAs through the Joint Building Controls Taskforce (JBC Taskforce). The new Building Consent Authority (BCA) accreditation regime will also produce quality manuals which will specify the processes that will ensure appropriate CPEng involvement (as well as appropriate use of Producer statements which need to be subject to the same rigour).

7. *Expanded technical leadership role for the central regulator.*
8. We believe that the BIA is starting to demonstrate the leadership role referred to. To further strengthen the ability of the BIA to provide this technical leadership, we plan to establish a Structural Advisory Panel. The panel will be made up of leading structural engineers and will meet quarterly with the BIA Chief Executive to provide a strategic insight into the design and construction industry and the key trends within it. The BIA is establishing a number of these groups to improve its access to strategic construction information and trends in the different sectors.

We note that IPENZ call for the BIA to identify and fund research necessary to inform regulatory and standard development. The BIA is currently funded to support Standards development, but not research to the extent envisaged by IPENZ. We comment later in this report on the need for wider investment into a building research program.

9. *Improved and more consistent consent and design checking processes.*
10. We agree that improved consistency and better quality TLA consent and design checking processes are required, and, when in place, will significantly improve construction outcomes. IPENZ have proposed a number of criteria for inclusion in the accreditation manuals for BCAs, and the JBC Taskforce subgroup on accreditation will review these proposals. In the meantime, TA feedback indicates a strong need for better benchmarking of current practice. The Taskforce is looking at how to best implement these programs ahead of the full accreditation regime. BIA plans to address this issue are also discussed later in this report in the context of the SKM recommendation on improving the standards of design reviews.
11. *Greater responsibility for building owners to engage qualified professionals*
12. The licensed practitioner regime in the new Bill will address these issues. Subject to the outcomes of the Select Committee deliberations, the BIA will also look at initiatives that would progress these objectives ahead of the five-year timeframe allowed by the current Bill. These will involve communication programs aimed at consumers.

13. *Better evaluation and certification of new untested materials before they are introduced into the market.*
14. The new provisions within the Bill for a revised product certification regime, along with new powers for the BIA to warn about or even ban the use of a particular product will address these concerns.

The BIA will also look at initiatives that would progress these objectives ahead of the three-year timeframe allowed by the current Bill. The BIA will work with BRANZ to ensure that their interim appraisal processes and approval criteria reflect the changes foreshadowed in the new product certification regime.

The Sinclair Knight Merz (SKM) report

The BIA commissioned SKM to address the technical issues raised by the Scarry report. It aimed to:

1. Identify issues that are, or could be, of significant concern in relation to the safety of buildings as built.
2. Comment on possible implications of those concerns in relation to the safety of building structures or parts thereof.
3. Comment on the likely extent of any significant concerns.
4. Recommend actions: in the short, medium, or long-term, which are needed to address the major concerns for both existing buildings and new buildings, and immediate steps or actions the BIA should take to address the major concerns.

The scope of the SKM report therefore focused on the following issues that could contribute directly to building safety through deficiencies in design and/or construction practices:

1. Deficiencies in reinforced concrete design practice.
2. Deficiencies in steel design practice.
3. Implications of the poor performance of precast concrete buildings in California.
4. Designing and constructing unusual forms of construction before testing.
5. Precast hollow core/end seating/brittle topping reinforcing concerns.
6. The unacceptable construction practice of multiple rebending of reinforcing bars.
7. Inability by designers to form proper structural concepts and load paths.
8. Five specific technical issues noted in Section V of the Scarry Open Letter.
9. Precast floor systems loading one side of a beam producing unbalanced load conditions.

The SKM report identified and commented on 24 different issues raised within the Scarry report and from them distilled five key actions that form recommendations to the BIA. It also included two further recommendations that go beyond its brief but which SKM believed should also be included as actions.

SKM recommends that:

1. The BIA issue a directive to the industry, and particularly consenting authorities, drawing attention to the concerns with the use of hollow core flooring systems and cold worked welded wire reinforcing mesh in high seismic demand situations. The report gives interim guidelines on the use of these systems and materials in all new structures.
2. The BIA commission further investigation into perceived deficiencies in Grade 500E reinforcing bar with a view to confirming or otherwise its adequacy for use in ductile structures.
3. The BIA supports and encourages existing and new investigation and research into all four issues of concern discussed in Section 6 of the report. (Precast floors, reinforcing steel, slender concrete walls and structural floors used as diaphragms)
4. The BIA initiates a survey of low, medium and high-rise building systems common in various parts of the country to determine the extent of the hollow core deficiency that may lead to building failure in a major earthquake event. The survey should be undertaken firstly on a sample basis, and depending on the results, then on a more extensive basis.
5. Where appropriate, recommendations in the form of guidelines or advisory notes should be circulated to industry groups to alert them to other issues raised in the Scarry open letter. It is suggested that a body such as The Structural Engineering Society of New Zealand (SESOC) with appropriate support from the BIA would be an appropriate organisation to undertake this.

The SKM Report identified two issues that were not strictly within the scope of the report, and considered them worthy of comment:

1. The BIA take action to increase to a uniform and reasonable standard the design reviews by consenting authorities of all structures lodged for building consent.
2. The BIA take action to ensure that an adequate level of construction monitoring is carried out on all structures.

SKM were also asked to comment on the possible implications of these concerns in relation to the safety of existing building structures or parts thereof. Their conclusions are given in chapter 6 in relation to each specific technical issue. They were not able to quantify the possible implications for the safety of existing buildings, but note that many buildings constructed prior to 1976 already have a lower level of seismic resistance than those constructed to more modern seismic design standards. They did point out

however that in many cases the failure under extreme loads of one element of a structure will not result in the instability of the overall structure

BIA Response

The BIA endorses these recommendations and comments as follows:

1. *The BIA issue a directive to the industry, and particularly consenting authorities, drawing attention to the concerns with hollow core flooring systems and cold worked welded wire reinforcing mesh.*
2. We are examining the guidelines proposed by SKM, some of which have also been proposed by the NZS 3101 Committee in a forthcoming amendment to that standard. We still have some concerns about the extent of continuity steel required to safely anchor hollow core flooring into its supports, but once this is resolved, we intend to issue a guideline, based on the SKM proposals, to industry and TAs. We fully support the proposals for the use of higher ductility mesh in seismic transfer diaphragms where yielding is a possibility in severe earthquake conditions. We anticipate that the guidelines proposed to clarify all these issues can be finalised and published before March 2004.
3. *The BIA commission further investigation into perceived deficiencies in Grade 500E reinforcing bar with a view to confirming or otherwise its adequacy for use in ductile structures.*
4. The BIA has already taken a number of actions in respect of grade 500E steel following concerns raised by the industry in June. We have issued an advisory note to TLAs and certifiers about the need for care during handling, and plan to commission new tests on the product to explore its behaviour in actual site conditions. We also have some concerns that the various NZS Standards may not fully cover high strength steels and the way they are used on site. We are therefore commissioning studies of the standards to review their adequacy and consistency. This study is planned to be complete by March 2004 and if changes are required to existing Standards, SNZ will be commissioned to start that process.
5. *The BIA supports and encourages existing and new investigation and research into all four issues of concern discussed in Section 6 of the report.*
6. Section 6 of the report covers four areas of major concern raised by Scarry; viz:
 - The performance of hollow core flooring in flexible structures,

- The used of cold worked and brittle wire mesh reinforcement, and
- The stability of slender concrete walls
- The performance of diaphragms.

SKM feel that there is a need for more practical research and testing to support the basis of the theoretical design methods being used.

Research in all of these areas is currently being carried out by the universities and by BRANZ. The existing programs are soundly based and generally reflect current needs. In particular, BRANZ and Auckland and Canterbury Universities have been managing research program on slender cavity walls, the outputs of which are due to be reported soon. However it is also clear that additional research is needed across a wide range of areas. We note that research of this sort is complex and expensive.

The Building Research levy is available to BRANZ to support research in those areas of building science that form the basis of the building control framework, and in particular the acceptable solutions and verification methods which operate within it. The level of investment in research required to support the wider issues raised by IPENZ and SKM exceeds that available from the current levy funding and also requires broader research capacity than that found at BRANZ.

I believe that the BIA should report back to the Authority on the results of a study that examines:

- The extent and cost of research necessary to support the building controls framework consistent with the aims and objectives of the new Building Bill.
- The research providers capable of carrying out such a research program, and
- The funding options for a research program and the preferred purchase arrangements for the research program.

There may be an opportunity to integrate this work with the review of the BRANZ research levy program currently planned by the MED.

7. *A survey of low, medium and high-rise building systems common in various parts of the country should be undertaken to determine the extent of the hollow core floor deficiency in existing buildings that may lead to building failure in a major earthquake event.*
8. This work has already started. An initial survey on the use of hollow core flooring has been followed by a pilot study, run in conjunction with Christchurch City Council, on the situations in Christchurch where hollow core flooring has been used. The pilot has been run to test proposed methodologies ahead of a national survey. The analysis will determine the extent of use of precast flooring units, especially hollow

core units, in buildings likely to have large interstorey seismic deflections. Once a representative number of situations where risk factors are higher than average have been identified, a more detailed analysis of the performance of the flooring in these situations can be undertaken. If that detailed analysis indicates that remedial action is required, the BIA will take appropriate action.

9. *Where appropriate, recommendations in the form of guidelines or advisory notes to industry should be circulated to alert them to other issues raised in the Scarry open letter.*

10. This recommendation mirrors the first IPENZ recommendation. It is important that the results of the investigations triggered by the Scarry report and the conclusions that are reached, be circulated to industry and TAs in a consistent manner. SKM have recommended that SESOC would be an appropriate body to do this work.

The guidance notes proposed by both IPENZ and SKM are fully consistent with the intent of the new Building Bill. The BIA is currently reviewing its plans for the production of the guidance documents specified in the new Bill and believes that outsourcing this work is a preferred option, although there are a number of other potential providers.

The BIA will seek the input of its Structural Advisory Panel on the scope and content of the guidance documents before seeking proposals from appropriate bodies able to put them together.

11. *The BIA take action to increase the standard of design reviews by consenting authorities of all structures lodged for building consent and ensure that an adequate level of construction monitoring is carried out on all structures*

12. This recommendation mirrors the fourth IPENZ recommendation. These actions will be directly addressed by the accreditation and licensed practitioner regimes set up by the new Building Bill.

Until these measures established by the new Bill come into effect, the BIA will work through the JBC Taskforce to ensure that consenting authorities are fully aware of the required standards for design reviews and carry out appropriate surveillance to monitor the uptake of the new standards. The BIA's own TA audits will continue to focus on the processes used for design reviews to ensure that they are rigorous.

The BIA intends to provide TAs with clearer guidelines on processes for accepting producer statements, as well as supervision of specific design. This can be achieved through our current building consent and inspection code of practice programs, as well as the best practice program currently under development by the Building Industry Improvement group in the BIA.

The findings of the SKM and SESOC reports will be directly circulated (with appropriate guidance notes) to Territorial Authorities to ensure they are able to take appropriate action when confronted with consent applications that involve these critical areas.

The SESOC report calls for the BIA to audit 50 completed projects each year on the substance of the design checks carried out by the consenting Authority. This proposal represents a significant change to the philosophies inherent in the accreditation process included in the new Building Bill. For that reason the BIA is proposing to re-look at this particular proposal once more detail on the design and operation of the accreditation process is available. In the meantime the existing TA audit program will, as part of its risk based approach to its review topics, look closely at the quality of TA design checking processes.

The overall objective of an improved standard of design reviews is to ensure that a reasonable and uniform standard of review is applied nationally, consistent with risk.

Conclusion

The John Scarry Open Letter has been a timely reminder of the complexity of structural engineering and the need to ensure design standards are uniformly applied and that practical research keeps pace with the building industry's demands for innovation, design theory and practice.

The Letter and its subsequent review by IPENZ and SKM has highlighted a number of important focus areas for the BIA.

In response the BIA should:

- Ensure that the coverage of SNZ standards documents is adequate, and where it is not, commission SNZ to address deficiencies and gaps.
- Ensure that accreditation and licensed practitioner regimes under the new Bill fully address the current gaps,
- Improve the quality and availability of guidance information on structural design and related construction issues, and
- Improve the relevance and availability of practical research to support the evolution of theoretical structural design.

The BIA is already planning to address the first three of the above items. The fourth item represents a new area of involvement for the BIA.

Where resources permit, the BIA business plan should be reconfigured so that it reflects outputs that deliver against these recommendations.

Recommendation

It is recommended that the Authority:

Note the content of this paper and, in particular, the four key BIA responses to the SKM and IPENZ reports.

A handwritten signature in grey ink, appearing to read 'R Martin', with a long horizontal flourish extending to the right.

Richard Martin
Building Industry Authority