CHAOS IN CONSTRUCTION:

THE FALL AND FALL OF NZ STRUCTURES.

October 2019

Abstract

Is there cause for serious concern for building structural safety in NZ? What could be done to improve the situation

Prepared by Concrete Structure Investigations Ltd (CSI): non-destructive testing (NDT) of concrete and steel

Contents

Executive Summary

Concrete Structure Investigations (CSI) has written an opinion piece from the knowledge gained from the non-destructive testing (NDT) of concrete and steel structures throughout New Zealand, being involved in litigation in the industry, some of our team having backgrounds in Construction Management and building on-site, and independent research.

Through this experience we have identified the issues as pressure on construction companies, due in part to negative pricing from a few big players. There has also been changes in regulations in the construction industry, a lack of independent reviews, enormous costs associated with building materials, use of variations to make ends meet, lack of profitability driving a lack of training and career path, labour shortages, passing of risk to others (including sub-contractors) from end to end in the process; starting from the developer/government institution.

Added to this is the PS (Producer Statements) and Council sign off systems not really working for a myriad of reasons, lack of accountability down the track; due in part to construction companies going under and finally a lack of healthy profit benchmarks set for construction companies so that they can survive and thrive. Through this paper CSI has suggested solutions including governance and regulation that would make the industry healthier, less stressful for those involved and ultimately produce a better result; sharing the pie amongst all of the players – not just the few.

About CSI:

CSI started in earnest in 2013 with a vision to be a highly specialised technical service to engineers who were adding to existing structures, retrofitting existing structures or checking their integrity

It is not an overstatement to say that we have been shocked by the state of many of NZ's building and infrastructure projects; our conclusion being that whilst the plans for construction may have been largely sound, the construction has often not followed the plans. This has been evidenced by key structural elements being left out, only partially completed or so poorly done they add little value in terms of the integrity of the building. Hence CSI has become increasingly involved in providing evidence in litigation - not the initial vision for the company.

In looking back through all of our projects we have formed the view that more often than not there is cause for serious concern for building structural safety. We have come to the point, after much contemplation and research into the last 40-50 years of construction, of trying to understand what has gone wrong.

Issues:

We have included a summary of the issues in construction as we see them, including any how's and why's, adding ideas for how this situation could possibly be fixed.

Pricing and regulation

NZ has had a perfect storm in the construction industry since at least the 1980s; somewhat brought about by the industry itself. We believe pricing and regulation are the crux of the issue. In order to get the jobs, construction companies attempted to avail themselves of competitors' tenders/quotes. This was facilitated by clients trying to drive the price down (most of these clients were probably developers). Construction bought in 'hook, line and sinker' to undercut one another to get those jobs.

Contracts and risk

We believe another significant factor was the clients trying to transfer the risk in the pricing, to the contractor. Who in turn has frequently tried to transfer it on to sub-contractors and so on. Clients seem to be prepared to pay considerable sums to come up with enormous and convoluted contract documents; in order that the construction company bear the risk. Sometimes, those construction companies get caught out. The wily ones try to pass the risk on – it would be an interesting exercise to estimate how much money is burned up in developing these convoluted contracts, not to mention the messy work-arounds that contractors come up with to try and mitigate this risk.

FOMO

Another factor we have considered is FOMO (Fear of Missing Out). This appears to be a strong driver for construction companies, especially on big and/or prestigious tenders. This, and the other persuasive element that the "next job will fix the previous job losses"

Deregulation and other factors

These factors, along with deregulation in the industry; removal of clerk of works, looser controls around appropriateness of new materials and building systems (e.g. pre-cast flooring), expensive building materials, removal of subsidised apprenticeships and an unclear aspirational ladder in construction (i.e. qualifications and training, job security and promotions). As a result, in some cases, there appears to have been a dumbing down of experience in the industry and an attempt to apply a 'corporate model' without taking into account the idiosyncrasies of construction, nor the experience required to manage it well.

Family businesses including those associated with a Development Arm and/or Construction Companies with a strong relationship with conscientious Developer/s; appear to do better and be far less involved with the issues in the industry. Additionally, there will be those companies who do a good job no matter what!

Lack of independent review and QA

In our view, until recently (albeit sporadically), there has been inadequate independent review of construction going on at the coal face. Producer statements (PS) for the industry have been around since 1991 and there is plenty of evidence of poor construction since this time. We talk more about the conflict with 'independent QA' further on in this paper as we believe there are flaws in the PS system. Without the presence of rigorous QA and sign off we perceive that there have been crucial work decisions made by inexperienced and otherwise inappropriate personnel. We provide some examples further in this paper.

Negative pricing

If construction is to be a profitable industry it needs to avoid negative pricing to get the 'big jobs'. As already alluded to, we have watched one or two big firms with other 'strings to their bow' drive the race to the bottom by what appears to be negative pricing. While this is now well documented and the consequences understood, it has been going on for 40 odd years. The concerning part of this equation is that the next cluster of tenders appears to sit at just above the 'losing money' line. How can this be? Why can construction not be driven by the same motives as most businesses around the world… and earn a reasonable profit?

Consequences:

If jobs are underquoted (or under-designed - we will address this later) what are the consequences?

1. Does it affect safety? Potential loss of life even?

2. Are shortcuts being taken to, in effect, claw back margin?

3. Is there an epidemic of QS's not questioning the viability in these jobs? The Government would appear to be the biggest 'Developer' in the country and has awarded tenders to companies that were well short of the mark in price and we would suggest the next cluster of prices sat well above them. We do wonder what due diligence was carried out? We understand that in some European countries there has been a Government Procurement Model where the bottom tender and top tender are taken out of contention and the choice comes from the middle cluster.

With Fletchers returning to the vertical construction market we wonder whether the NZ Government behaviour is going to continue? If Government is going to choose unrealistically low prices the same knock-on effects will continue to destroy the construction industry. It seems a few commentators are already raising concerns about the ability of Fletchers to reinvent themselves https://www.nbr.co.nz/opinion/fletcher-talking-big-game-bi-revival

4. If the construction company plans to 'make up' the money required for the job on variations, the client ends up paying the required amount to get the structure up at any rate! If there are developers/clients out there who rely on the job being done for the first price, the variations have the potential to drive them to financial ruin. Variations were intended to exist in cases where genuine unforeseen expenses arise. For example client change of mind over an element going in or change of scope etc - not as a strategy to insert profit into a job that was under-priced.

5. Professionals involved should be pointing out shortfalls in design, materials, time-frames, QA and not hoping for the best, as this is always unrealistic. Hence the advent of liquidated damages (LD's) to make up shortfalls. The cost of LD's is money that could be spent on doing the job right in the first place.

6. Poorly designed and/or constructed buildings start to show signs of weakness so will need retrofit at any rate. Having been involved in court cases around questionable behaviour, either of developers or construction companies, it seems that the parties involved were well aware that the issues were significant but apparently ignored them.

7. For those structures that are poorly built but don't show signs of weakness before an 'event' (e.g. earthquake) , failure of those buildings, plus serious health and safety risks will very likely follow.

Possible Solutions

Raising the bar

In our opinion, the bar must be raised for everybody involved in construction. It is not about somebody ticking boxes on a form or a builder 'signing off' the work. It is about really being sure of what has been done i.e. QA. These tick boxes have existed for years and have made very little difference to the industry. **It is all about regulating for professional, frequent and rigorous checks by independent bodies paid for by the client (using appropriately trained and qualified people)**.

We acknowledge that the original design engineers for any structure should make up part of the QA process, as they are knowledgeable about what the design is hoping to achieve in terms of the integrity of the structure – but a layer of independent engineer/s is also required. We have had design engineers report that they are under pressure from the client to progress the erection of the structure without costly delays, we assume this could lead to a less than rigorous process. Word would soon get out about those firms that make life difficult! By having an Independent Body sign off there is no muddying of the waters between client and engineer when it comes to QA

Engineer input

From listening to engineers, it seems they feel pressure at certain steps in the process and for sign-off. Is this sign-off system really working? Firstly, engineers are not independent if they are the design engineer/s, or working for the same firm, and secondly, it is not rigorous enough. Engineers have raised with us the difficulties of getting to site to sign work off. There are a lot of last minute calls from construction staff putting pressure on the engineer to turn up fast as "the concrete truck is waiting" (busy engineers often find this hard to do). Or photos supposed to be taken of key elements - and then not taken etc etc.

Another issue raised by engineers has been the apparent subliminal pressure that is occasionally applied to them to 'economically design' buildings, instead of designing purely for 'structural integrity' alone. We believe that at consent stage there is a peer review of the design by Council Regulatory Authorities, begging the question of how even marginal under-design could be agreed?. However, we are led to believe this can still be an issue. Most recently we saw this article on Stuff identifying some questions being raised about the design and consent process https://www.stuff.co.nz/business/113226624/new-engineer-spotted-alleged-defects-in-christchurch-highrise-from-the-street

However, the design issues are a little off topic, albeit related. They are concerns for Structural Engineers to address and as the following paragraph demonstrates, clearly some of the leaders in their industry are questioning pressure to design economically.

At the Pacific Conference on Earthquake Engineering 2019 David Hopkins presented a paper titled "Park and Paulay Lecture: Improving Earthquake Resilience of New Zealand Buildings. Who Cares?" https://www.confer.nz/pcee2019/uncategorized/hopkins/

Costs

Finally, a perspective put to us from professionals responsible for pricing in the industry, is the prohibitive cost of building materials in NZ. While we 'talk the talk' on free trade and open markets, we appear to have enabled a monopolistic model for the pricing of construction goods (this is not the first industry in NZ in which we have done so).

Some even mentioned that in previous decades 'price fixing' was employed so that new importers coming into the market could not drop below current major supplier/s for some critical materials. It is also true that some developers gain considerable profit despite these prices. However, in doing our research there are some case studies of the opposite being true. **One factor that seems to be a constant are the slim (or non-existent) margins for construction, if not 'negative margins'. It would appear that the construction industry bears the brunt of decisions made at National and Local Government level and Developers (including National and Local Government) trying to drive construction prices down.**

Regulation: (At CSI we advocate that our own NDT industry should be regulated also, but that is an argument for another day).

We can look to countries like Germany for examples of their compliance regulations and QA.

We are not actually fans of over-regulation but there are 8 crucial over-arching concepts that need not be complicated:

1. Appoint an independent body of professionals to check the structures. Regulate so that every developer (including Government) must employ professionals from this independent body to check the construction of their building/infrastructure at regular intervals and sign off must occur on all key structural elements after comprehensive and independent QA.

2. Introduce a regulated pricing model. For example, a pricing model that could become a regulation is the Cost Plus (Open Book) approach employed in NZ and in some European countries but with a benchmark of 10-15% margin as the lowest point for the construction companies appointed for the work (sometimes this benchmark is up to 20% overseas when demand is high).

We are clearly making mistakes in terms of pricing QA in New Zealand. This method would mitigate much of the current poor practice. Construction companies could then decide their margin for each job from a base of 10-15% and offer more value over and above to their customers as mentioned on page 8 of this document. (We mentioned earlier a Government Procurement Model that may certainly help the situation, but even so the Open Book approach would be more transparent).

3. Connect the players together so that site/construction managers must co-sign for key elements as well, ensuring construction takes responsibility for correct completion of their job.

4. Could there be personal and company liability for abuse of current building standards?

5. Training programmes and qualifications appropriate to the construction industry to be compulsory. With only 10% of firms training and the industry showing considerable gaps in expertise, upskilling staff is paramount. https://underconstruction.placemakers.co.nz/bcito-backs-mbie-procurement-plan/

6. Rigorous and independent ongoing testing of building materials, applicators and building systems (i.e. not the NZ company that is going to use them/sell them), taking into account the NZ environment (both in terms of the natural environment and the construction environment as it is currently).

7. Welcome construction materials competition into the market. This NBR article demonstrates it is still a challenge to compete with the current building materials monopoly/ies in NZ: https://www.nbr.co.nz/article/knauf-takes-fletcher-plasterboard-market-nz-mulls-high-costs-building-bd-148919

8. Extend warranties and building defects guarantees to better reflect the time it takes for flaws to show up. Corresponding more closely with the European (EU) models. Warranties and guarantees could be beefed up to meet developed countries overseas (5 to 20 years), from the NZ standard where you have 1 year to identify defects and up to 10 years for the builder's warranty to expire (there is some variance within the cap of 10 years). "The pressing need for a mandatory scheme is evidenced by the fact that over half of all construction companies in New Zealand will have closed after just four years. And 75% will have failed within 10 years". (https://www.shinelawyers.co.nz/services/construction-law/)

These 8 points illustrate how the industry can be driven by a top down and bottom up form of regulation, which is designed to stop 'defects' from occurring.

Pricing and Use of Sub-Contractors:

We believe there is a need for a change in the trend towards negative or unsustainably low pricing. We approach it from the perspective of quality control via independent checks on site but this is only one part of the puzzle so we have put forward a pricing model in Point 2 (previous page) to try and find solutions for the current malaise.

It is undoubtedly an issue that construction does not behave like most businesses in terms of pricing for a reasonable profit. It must be a stressful way to run a business. The reliance on variations is a bit of a false economy in so many ways. We have mentioned that it appears to be a way to hide the real cost when delivering the quote. It is also an enormous drain on resources (including time) for drafting up, justifying and possibly even defending in court. In our opinion, the reliance on variations to reclaim profit on a project leads to dysfunction and nefarious behaviour in the industry.

In recent times there has been some commentary about a dysfunctional relationship between main contractors and sub-contractors; initiated by the fall of Ebert Construction (Stuff business article: 26.10.18). https://www.stuff.co.nz/business/108095793/the-construction-industry-faces-big-hurdles-to-lift-its-game . We believe some of the reported conclusions are on the mark but it is not the crux of the issue. In a boom time why are construction companies slitting each other's throats on price and why do we not have thriving construction companies making a fair profit?

There is a need for sub-contractors on most jobs and this we acknowledge – particularly when labour is tight. For a start, buildings need plumbers and electricians. These sub-trades also need the independent regulations and checks that the rest of the industry requires. Because of negative pricing and appallingly low profit margins the construction companies endeavour to reduce risk by moving it to sub-contractors (if they can) or at the very least not establishing a workforce of employees because of the inherent financial responsibility this entails.

To be fair sometimes subbies are needed for their specialty skill/s and shortage of labour can get in the way of developing one's own workforce. The advantage of subbies is that when there is no work on you do not have to pay anybody. However, this system, when maximised, creates disjointedness in the extreme. The main contractor should not then be able to 'pass the buck' for any mistakes subsequently uncovered.

In conclusion:

You cannot leave sign off for key structural elements to the design engineers' junior, nor the construction company building it, nor the say-so of sub-contractors, or the client's QS (e.g. Article: "The Need for Quality Testing" by Garland Likins, President, Pile Dynamics. http://www.piledrivers.org/files/22969824-f476-4f92-8313-06533147872b--b96b439b-9587-4e2d-86e7-41357faf78ee/publication-q2-2011.pdf p.59).

We believe that the element missing in this article is independence, but we otherwise agree that checks need to be professional, rigorous and frequent.

We need a construction industry that can make a fair profit – enabling all of that good workmanship that comes from profitable companies that have training programmes and qualifications, a sense of team, an aspirational ladder for career choice, ongoing fairly appointed tenders and jobs to keep the workflow going.

Prospective clients can then choose their construction partner via an informed evaluation of the company values, experience and performance e.g.

1. Company culture
2. Record of excellence in construction
3. Buying power in terms of materials and number of staff or a more personal experience offered by smaller firms
4. Successful partnerships in construction
5. Innovation
6. History of sound programming and reliability of delivery
7. Staff training programmes ..... and so on

As an aside we raise here several items that are related to our paper, even if not directly:

1. Perhaps there is an explanation for all of the dubiousness around National Building Standards (NBS) Ratings, and it is QA on site. We believe it comes down to the same issue: does anyone know what really went into the structure/s as opposed to what was written in the plans? Or the quality of what went in?

2. In terms of anchors, fixings and fittings that are used on site; these should also have independent QA as it leaves the way open for poor practice if the applicator/s are checking their own.

3. The schmoozing that allegedly goes on between Government, Local Government, Monopolies and Developers is legendary – leaving the way open for construction decisions and regulations, in all their forms, to be made with questionable motives, in our opinion.

Appendix/Examples

At CSI, with our experience in the NDT field and in litigation, we find the majority of buildings we deal with clearly have issues, hence our involvement; but they are often not built to plans (which can include substandard workmanship in terms of the completion of key structural elements). We finish here with a few examples of what we have come across in our non-destructive testing work:

- We were 7 or 8m below sea level in the basement of a large construction project near the waterfront where the water proofing was botched. Load-bearing walls were saturated with water. There was severe saltwater ingress in the new construction due to failing/poorly installed tanking. We observed:
  - Construction worker would lay live power leads through puddles.
  - A significant number of drossbachs were compromised or empty. Some of which were filled with sea water.
  - What was shocking was to see this construction being continued on despite the basement being compromised. At the time we were working there, levels above were being erected. All that load was bearing on panels with compromised connections and seawater compromised concrete panels, certainly enabling corrosion. And from the outside was the pressure of tons of water against the structure.

Figure 1: Compromised basement construction

- One structure, we found that around 20-30 percent of the drag bars were missing. The reason we were asked to look at this was due to the obvious signs of stress caused in the Kaikoura earthquake.

- In a basement carpark we found water features behind the walls and in a building that was 6 years old at the time and had corroded reinforcement with up to 50 percent in section loss.

Corroded Reinforcement

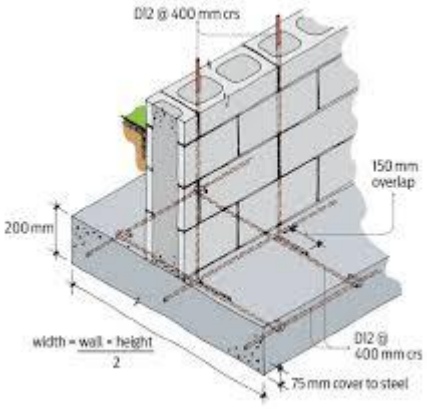
- We undertook an initial random sampling of drossbachs on a modern building and found a 100 percent **fail** on the correct installation of drossbachs

Drossbachs

- On a large project we have carried out 200+ image scans throughout a structure that is isn't finished yet and we can say that 30 percent of the scans came back with non-compliant cover.

Compromised cover

- At a construction underway, voids were found in the foundation wall. Basically, we were left with the impression that as soon as we could identify a problem on this job pertaining to large voids in the wall the client was keen to see us offsite. This is our impression of our work with them.



Foundations

- In some instances where issues have become evident in new structures, no investigation is undertaken because the clients don't believe they should pay such a price for QA on new buildings.

- For the sake of using the right concrete a critical lifecare asset was shut at a cost that can't be quantified as health and safety was at issue.

- On one project, in some locations the slab reinforcing had sunk to the soffit and was virtually protruding out from underneath. We were called upon as witness for this job a year or so later.

** CSI has implemented a 'Duty of Care' letter/report where we have grave concerns about key structural elements.*