



QUALITY AND COMPLIANCE: STRUCTURAL STEEL INDUSTRY TAKES THE LEAD

Ten years ago, New Zealand's structural steel industry turned its attention to quality and compliance in earnest. In the time since, it has delivered multiple initiatives to drive best practice and help 'raise the bar' across the sector.

But to give context to the momentum of the past decade, we have to look back even further in time. In 1984, the 103m-high BNZ Centre was finally completed, albeit six years late and four times over budget. The Boilermakers' Union of the day had claimed the sole right of its members to weld the structural steel; the ensuing industrial

action brought work on the structure to a standstill and caused structural steel to fall out of favour in New Zealand for many years.

Even so, the industry didn't stand idle. It recognised that implementing standards would create a foundation for future development of the structural steel market; it also understood the importance of steel fabrication. The Heavy Engineering Research Association (HERA) - from which Steel Construction New Zealand (SCNZ) would eventually spin out of - worked to develop welding standards like

AS/NZS 1554.1 Structural steel welding - Part 1 to support fabrication. It also understood the importance of training in the steel industry and delivered a range of courses including NZ Welding Engineer and NZ Welding Supervisor.

"So while steel's market share was quite minor compared to other building materials, we created conditions for the market to grow. We set the foundations with the standards framework, training schemes and guidelines for engineers," says Michail Karpenko, General Manager Welding Centre, HERA.

QUALITY IN CONSTRUCTION – A BIRD’S EYE VIEW

The weathertightness issues that came to light in the 2000s drew attention to quality and compliance practices across the broader building industry, says Wayne Carson, Managing Director, D&H Steel Construction.

“The whole building industry had a shake up with the leaky homes syndrome and everyone has worked to improve their technical information,” says Carson. “All sectors of the construction industry acknowledge that, to avoid liability, there needs to be a high level of compliance.” But, he says, there is still more to be done.

Vijay Patel, Technical Director Structural Engineering, Beca, believes there is variability across the building industry; some contractors have a high level of quality assurance practices, while others are lacking. Much depends on the nature and size of the work – larger projects typically demand better processes. He says there is also inconsistency amongst consultants in terms of what they enforce.

“Unfortunately, this does give a confusing message to contractors because there is no standardisation. While they might work with one consultant that simply wants to see a

producer statement at the end of the project, another may demand to see their methodology, quality assurance process, steel installer certification, welder certification and everything else in between. So that standardisation isn’t there.”

Terry Buchan, GM Major Projects, Hawkins, gives the building industry seven out of 10 for its quality and compliance. He says that, while it is better than it was, there is still room for improvement. “We don’t understand designs as well as we should do. Too many designs in New Zealand are bespoke; it creates risk; we need to simplify things.”

Buchan notes a heavily reduced supply chain and immigration challenges are both affecting the industry’s ability to do more work. “We can’t take on more complex buildings or increase manufacture with fewer people, so we need to standardise a raft of things to simplify the building and manufacturing process.” He says that will come with modular and prefabricated design solutions – working in factories rather than working on construction sites where a best-for-project mindset should apply. “For years, the steel industry has led

that area of construction where they build it once virtually, then build it a second time manually in their factory; by the time they erect it on site you know the structure is going to be perfect.”

Meanwhile, residential is lagging behind the commercial sector, says Aaron Campbell, Managing Director, Pengelly Engineers. The scale of commercial projects demands more developed processes, and these have been evolving with the industry for some time. The residential sector’s trajectory, however, has been quite different.

The residential house market has changed considerably in the last 10 years but its processes have been slow to catch up. House builders used to build houses one by one, then progressed to building multiples of 10 and developments of 20-plus houses. Tight sites, too, have become more the norm and there has been a proliferation of terraced housing. Now, more than ever, it’s important to ensure homes are structurally sound.

TAKING THE LEAD

Ultimately, it was the 2010 Stadium Southland roof collapse followed by the Canterbury earthquakes that accelerated the structural steel industry’s work in the quality and compliance space.

New Zealand was lagging behind international trends, says Carson. “In terms of quality and certification frameworks at that time, New Zealand had nothing. It was a significant step to focus on quality and compliance.”

Today, as a result, the structural steel sector is generally perceived to be ahead of the wider building industry in that space.

Buchan says the quality and compliance of steel manufacturers in New Zealand is a step ahead of most other industries in the wider construction ecosystem.

“THEIR PROACTIVENESS, THEIR ABILITY TO DRIVE CHANGE, SET UP THEIR OWN STANDARDS AND GET AHEAD OF THE GAME, WHICH MANY OTHER PARTS OF THE INDUSTRY HAVEN’T DONE, IS A CREDIT TO THEIR SECTOR.”

TERRY BUCHAN, GM MAJOR PROJECTS, HAWKINS

But what drove this?

“They’ve had to do this to get ahead of the game and give themselves a point of difference.” Structural steel has had to compete, first with rival materials like concrete then, more recently, with structural steelwork imported from

low-cost economies. The industry has had to prove that it is a better, faster and more precise solution. “You only get one shot at it; you can’t afford to get it wrong.”

Carson agrees. “Our market was being threatened by overseas’ influences, which was putting our quality in question. We needed a benchmark and a level playing field to measure quality and compliance. So our structural steel industry took the initiative to establish clear guidelines around compliance.”

In 2012, SCNZ and HERA began to engage with industry to identify the best quality management scheme for New Zealand. In the wake of the Canterbury earthquakes, the industry had to scale up to match the demands of the rebuild. The pair guided the industry as it scaled up in response – an emphasis on training and quality management played a big part in this.



Structural steelwork was good in New Zealand prior to the earthquakes but the concept of quality management was still in its infancy. Most structural steel contractors were focused on quality assurance, inspection and quality control, says Karpenko. “These days we talk about quality management.”

A critical element of quality control in steel fabrication is welding – should anything go wrong welding will likely be to blame. “We agreed on the need to get welding right first.”

It was an evolutionary process. HERA and SCNZ leveraged their strong international connections to fully explore best practice offshore with a view to adopting it in New Zealand. The pair looked at the North American, European and Japanese standards. “We were able to cherry pick. Some of our concepts have been adopted from North American practices, because they are quite advanced in seismic design. We also adopted quality management ideas from the European standards,” says Karpenko.

“The beauty of New Zealand is that we are much more flexible than larger countries. If we have a good idea, we can implement and adopt it much faster. The local steel industry used it to their advantage.”

STEEL FABRICATION CERTIFICATION

Steel Fabrication Certification (SFC) was launched with the publication of the SFC Code of Practice (COP) by SCNZ in 2014. This COP became the basis for the scheme’s underlying

quality standard, AS/NZS 5131, which is based on the European standard EN1090. The industry-led quality scheme provides independent, expert certification of New Zealand fabrication companies and is a cornerstone of the industry’s quality and compliance activities. Today, more than ninety percent of the sector’s annual output is delivered by SFC-qualified fabricators who manufacture structural steelwork to international best practice.

Over time, other quality assurance initiatives have been developed by the industry to complement SFC. These initiatives provide procurers and specifiers – such as engineers, head contractors and architects – with certainty of product quality and significantly reduced compliance risk. This is particularly important at a time when independent on-the-ground quality assurance of prefabricated structural steel sections procured from low-cost offshore sources is difficult to achieve.

Andrew Boyd, Principal Project Lead Building Consents, Auckland Council, says there is little doubt that, while there is always room for improvement, the structural steel industry scores well in the quality and compliance space, particularly now the requirement to demonstrate compliance to AS/NZS 5131 is cited in the B1 building code.

“The industry enjoys certain benefits from being a relatively small section of the New Zealand construction industry, which allows for close cooperation, sharing what works and, just as importantly, what doesn’t,” says Boyd, noting the industry’s openness, and willingness to share and improve.

It has led the steel industry to take the lead in other complementary spaces. “They’ve really stepped up and driven things like technology,” says Buchan. “BIM [Building Information Modelling] was first implemented through steel manufacturing, well before mechanical services and construction really took on board the 3D solution.” BIM designs have driven quality through manufacture and installation, he says, and different trades have taken note of what the steel industry is doing well. “They have been a catalyst for driving innovation and change.”

10 YEARS OF QUALITY AND COMPLIANCE

In the past 10 years, SCNZ has rolled out a range of initiatives to raise the bar in the quality and compliance space.

- Steel Fabrication Certification:** launched in 2014, the industry-led quality assurance scheme ensures participating structural steel contractors have appropriate personnel and quality management systems in place representing international best practice.
- Distributor Charter:** ensures that structural steel supplied to the local steel construction sector is sourced using best-practice procurement. It represents a mark of excellence for structural steel distributors in New Zealand.
- New Zealand Guide to the Sourcing of Compliant Structural Steels:** simplifies the local practice for demonstrating the conformity of structural steels.
- New Zealand Structural Steelwork Specification in Compliance with AS/NZS 5131:** published in 2016, the specification is a tool to help engineers and industry to implement AS/NZS 5131.
- Bolt Importer Charter:** ensures that fasteners and anchor bolts supplied to the local steel construction sector are sourced using good procurement practice.



CONFIDENCE FACTOR

These industry endeavours are the reason Patel rates the structural steel sector higher than the wider market in quality and compliance. “I’d score it an eight out of 10, up from a six just 10 years ago. Without the likes of SFC we’d need more documentation from fabricators to make sure we are comfortable with what is being undertaken within their fabrication yards and provided on site.”

In the past there was a lot of variability, but the industry’s introduction of quality and compliance initiatives has helped to standardise much of the sector, says Patel. Today there is good regulation for the use of structural steel, which needs to conform to strict guidelines and codes such as 3404 and 5131.

“THE STEEL INDUSTRY HAS RESPONDED BY DEVELOPING PATHWAYS TO MEASURE AND DEMONSTRATE COMPLIANCE, AND PROVIDING THE NECESSARY DOCUMENTATION IN AN EASY-TO-USE FORMAT. IT GIVES DESIGNERS THE CONFIDENCE IN THE PROCEDURES AND THE QUALITY THAT IS PROVIDED.”

VIJAY PATEL, TECHNICAL DIRECTOR
STRUCTURAL ENGINEERING, BECA

“Who the contract is awarded to is often outside our control, but that doesn’t matter if they are SFC qualified. We know that standardisation is there because it has been regulated by an industry body,” says Patel.

Material quality is critical at a time when engineers are being asked to push the boundaries with their designs. They are exploring ways of getting more out of the structure, such as larger spans. “Engineers are personally liable; we have to sign producer statements based on a design, but that design is only as good as the workmanship or the materials you are using,” says Patel. “Having confidence in the properties of materials without having to overdesign benefits everybody.”

Carson says the initiatives have had a significant impact on the structural steel industry. First, he says, it has improved the consistency of

QMS EVOLUTION

Early on, the quality of steel structures was largely based on the skills of traditional tradespeople available in the industry and an underlying set of standards.

Businesses like Pengelly Engineers once relied on tradespeople that had cut their teeth doing apprenticeships in large industries like the railways and shipbuilding. All those tradesmen had their own “opinions and quirks”, which affected the manufacturing process, says Campbell.

When those tradespeople retired, a gap opened up. The government of the day privatised large entities like New Zealand Railways and Ministry of Works, which had been training and feeding all of the trades and engineers into the wider market. When that supply dried up, the industry was slow to replace it with its own training programmes.

The structural steel industry was forced to enlist local semiskilled labour that didn't have the benefit of trade experience and required more guidance. They were supplemented by experienced workers from overseas with different skillsets. It led to a heavy reliance on processes and systems to safeguard fabrication quality and additional training schemes to support it.

“Structural steel fabrication became less reliant on individuals and more reliant on the quality management systems that work to integrate and upskill people,” says Karpenko.

HERA recognised the need for formal training and developed the qualification AS/NZS 2214: Certification of welding supervisors – Structural steel welding, which is now required by AS/NZS 5131 and SFC. The certification scheme relies on quality systems, of which people play an essential part. “We have been training on average 50 welding supervisors per year with SCNZ's support.”

The entire quality and compliance narrative changed from inspecting compliance to implementing a quality management system (QMS). It meant that the quality management knowledge and skills were retained within the company rather than relying on third parties to inspect the product.

“Quality cannot be inspected into the product; it should be built into the product,” says Karpenko. Requirements for the quality management system were developed over the course of 2014. First the SFC rules were developed – the code of practice that became the backbone to the new standard for the

quality of structural steelwork, AS/NZS 5131. SCNZ, HERA and the Australian Steel Institute worked closely with industry to build the standard, which was published in 2016. “We set up the certification scheme to be based on a standard, so we had the scheme and the standard to back each other up.”

Carson says it has driven much more consistency in identifying best solutions. “The best thing that we've done is to upskill and introduce a level of professionalism, which has taken us great steps forward as an industry and positioned steel as the material of choice.”

“TODAY, OUR INDUSTRY IS MUCH MORE SOPHISTICATED AND MORE HIGHLY EDUCATED; IT OFFERS LOW-RISK SOLUTIONS THAT ARE WELL PROVEN, WELL DOCUMENTED AND REPEATABLE ACROSS THE INDUSTRY.”

WAYNE CARSON, MANAGING DIRECTOR, D&H STEEL CONSTRUCTION

specifications from designers thanks to a clearer and better-defined framework. Second, it has driven a big improvement in the professionalism of the steel industry.

“We are leading the pack now. We've covered off all the key ingredients that make up structural steel – material compliance, workmanship compliance and supply chain compliance. Our industry now has a well-linked delivery model and quality and compliance is at the forefront of each party that contributes to the process.”

D&H Steel has reported a significant reduction in rework and much greater consistency across its team because the quality expectations and responsibilities are well documented and clear. Initially, says Carson, it was difficult to implement change within the business and ‘bed in’ the new processes. But before too long everyone realised the significant

benefits; now it's ‘BAU’. “And there is way less stress. We've moved away from the ‘holy shit’ moments.”

D&H also has much closer relationships with engineers and builders. “There is a much greater level of respect and they take comfort in knowing that they can rely on us to deliver on what we say. Through our systems and our documentation we are held accountable for our work.”

Buchan agrees, adding that the structural steel industry's quality and compliance initiatives give people more confidence that building with steel will be “right from day one”.

While building structures hasn't changed much as a result, he notes that the sophistication of some steel contractors' operations has and they are showcasing their smarts and technology with designers. Buchan says it's not unusual for designers to

approach structural steel contractors directly to tap into their expertise before they get too advanced with their building designs.

“You can't afford to get it wrong. The quality and compliance of materials needs to be foremost in our minds,” says Buchan, which includes a clear chain of custody so the steel can be tracked from mill to site. “All of that QA is really important; not many other parts of the industry that can do that.”

Buchan notes there are some builders that use offshore supply and manufacture. “We've typically stayed away from that and stuck with the tried and tested. There are some horror stories with offshore prefabrication.”

Pengelly Engineers chose to become SFC qualified because it cares about providing proper engineered solutions.



“WITH SFC, YOU ARE FOLLOWING A PROCESS, TICKING LOTS OF BOXES, AND IT ASSURES US THAT EVERYTHING IS DONE PROPERLY.”

ALFREDAS TAMOSAUSKAS, DESIGN & QUALITY ASSURANCE MANAGER, PENGELLY ENGINEERS

The upshot of good quality and compliance for Campbell is peace of mind. “It’s called ‘Aaron gets a good night’s sleep’.”

Alfredas Tamosauskas, Design & Quality Assurance Manager, Pengelly Engineers, agrees. “It’s important that when I go home I feel safe that I did everything as it should be done, so I can just forget it because I know that it was done correctly.”

SFC also covers the procurement of components used to produce the final product and provides assurance that they have been manufactured correctly. Similarly, the Distributor Charter applies specifically to steel suppliers. “It is a fantastic initiative,” says Campbell. “I have four suppliers that I can confidently send a schedule to for pricing and know that they won’t supply me with rubbish. I don’t have to check every single item of steel.”

The relevance of the quality and compliance initiatives is increasing in the residential space where there are

more and more requests for warranty documentation. But Campbell notes there are still some parts of the residential industry that are driven by cost rather than quality. Some quantity surveyors are focused on the upfront cost rather than de-risking and achieving cost savings by avoiding programme delays. “With SFC, we can create a schedule and move into other people’s programming without delays. Unfortunately, many quantity surveyors don’t see the value; they haven’t done the maths to understand how much a two-week delay costs them.”

It took Pengelly six months to achieve SFC. It spent the next couple of years refining its processes. “When we had all of the systems in place and were using them we could see that some weren’t as efficient as we thought. Even in our fourth year, we are still improving and changing. It is an investment for a better future,” says Tamosauskas.

Another consequence of the industry’s focus on raising the bar is the camaraderie it has created amongst fabricators. “They are willing to help each other. Prior to that it felt a little adversarial. Now, they are very open with their information and their processes,” observes Campbell.

Boyd says the work done by SCNZ not only raises quality and compliance issues, it offers industry solutions that industry frequently uses. “These assist Council in having options to share with applicants as possible ways to

demonstrate compliance. [All of the initiatives] are linked and equally influential and important, and should be considered as a whole. Initiatives such as these lead to improvement in all aspects of compliance and quality so of course the impact is very high and productive.”

“THE INDUSTRY HAS BECOME STRONGER, MORE RESILIENT AND MUCH MORE AWARE OF THE QUALITY MANAGEMENT REQUIREMENTS OF APPLICABLE STANDARDS. THEY ARE MORE SELF-CONFIDENT, RELYING ON THEIR KNOWLEDGE NOT SOME THIRD PARTY ADVISING THEM.”

MICHAIL KARPENKO, GENERAL MANAGER WELDING CENTRE, HERA



COUNCIL ENGAGEMENT

SCNZ proactively engages with local authorities on the compliance of structural steel and, more specifically, Auckland Council and SCNZ have joined forces to visit metro councils and share the work currently being done in the structural steel quality and compliance space. "It has been very well received, which allows the opportunity to create a consistent approach," says Boyd.

Part of Council's role is to assist in maintaining a high level of compliance and quality, he says, and ongoing engagement with SCNZ, as with all stakeholders, allows Council to continue improving how it delivers on its regulatory obligations.

"CONTINUAL IMPROVEMENT IS ALWAYS AN ASPIRATION AND THE NEW ZEALAND STRUCTURAL STEEL INDUSTRY AND COUNCIL ARE VERY GOOD AT IDENTIFYING THOSE OPPORTUNITIES AS THEY ARISE. LET'S SEE WHAT THE FUTURE OFFERS."

ANDREW BOYD, PRINCIPAL PROJECT LEAD BUILDING CONSENTS, AUCKLAND COUNCIL





WHAT'S NEXT?

The structural steel industry has covered plenty of quality-and-compliance-related ground over the past 10 years. So much so that it has arguably emerged as a clear leader in the space compared with other construction materials, and with the wider construction sector. It is intent on retaining that momentum.

SCNZ is in the throes of completing its latest initiative - the Metal Decking and Stud Welding code of practice (COP). The COP sets out minimum requirements for metal deck construction, which are aligned with those of the recently revised stud welding standard AS 1554.1:2021.

What then? High on Patel's wish list is mandatory SFC for all structural steel contractors, which has driven standardisation of much of the structural steel industry, including the

quality records provided. "Mandatory certification would give us confidence across the board."

Today, 57 structural steel fabrication companies nationwide, representing 92.5 percent of the sector's annual output, are SFC qualified.

"Our immediate focus is to try to get everyone on board; we still have a handful of companies that we are encouraging to join SFC," says Karpenko.

Going forward, the industry will be firmly focused on streamlining the existing quality and compliance initiatives - making them work as seamlessly and efficiently as possible. Technology will play an important role.

The structural steel sector aims to improve the compliance scheme's efficiency by taking inspiration from Industry 4.0. Called compliance

monitoring 4.0, it is where the industry's digital interconnectivity comes into play. HERA has initiated pilot projects with universities and industry to explore how it can implement some of the concepts.

Karpenko says the industry continues to evolve and at some point it will have an Industry 4.0-based system driven by AI and machine learning. It will facilitate compliance and give the market even more confidence because it will be based on big data.

"That's what excites me," says Karpenko. "Our industry sits on a goldmine of data. If we help companies to leverage their information it will improve their efficiency, productivity and enhance our understanding of quality. Real-time compliance monitoring and data mining with little human involvement is our aspiration. Decision-making based on data is the future, and compliance monitoring based on data is part of it."