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Gavin Cormack – Executive Chairman, Beca Consultants

Some believe concrete to be a boring inanimate compound. This is, of course, not so. It has been the object of great thought, pain, and passion, has created great beauty, and for some has also created significant wealth.

I will explain the part your Society played in arousing these powerful emotions and, given your commitment, how you can continue to do so.

Fifty years ago New Zealand was effectively state controlled. All significant decisions were made by government. Even the engines that the state owned international airline would put into their planes were decided by the Prime Minister.

For concrete virtually all major projects: their expenditure, design, construction and maintenance was controlled by Government employed engineers. They set standards, did most of the design, the professional training, and had little, if any, accountability to the public. This was a mixed blessing. There were some inspiring leaders. There was little personal or corporate accountability. Professional liability was rare. As the state controlled all, paid all, it also carried all risks. Contracts were administered autocratically. Innovation/new products - hard to promote. Advancement in Government service did not go to innovators. Outputs were likewise mixed. There were some outstanding achievements and some cases of deplorably conservative and costly design and decision making.

To progress, the concrete industry had to develop a sound commercial base and move out of central government control. This achievement was led by a remarkable man. Sandy Cormack. As you have heard I knew him well. He was my much loved father. His strategy, which he executed with determination, was to develop independent, industry regulated quality control, and to convince purchasers and specifiers to accept concrete that came only from plants that had passed the industry standard for Plant Grading and Certification. In so doing he educated the public on the benefits of quality and eliminated the threat both to the industry and the public posed by competition from low cost low quality producers. This certification scheme is still operative nearly 50 years later.

His own company was Certified Concrete which he led for many years with an unrelenting focus on quality.

The outcome was high quality concrete, available throughout New Zealand. The concrete Industry was of such a standard that concrete technology was barely taught at university because there was no need. All concrete was truly "Certified" as of acceptable quality.

And so the control of concrete was wrested, not without difficulty, from government control and a strong industry flourished and expanded. This contributed to a substantial creation of wealth for the major players in the concrete industry.

This was in fact an era of significant wealth creation in NZ. Although salaries were low, and creation of personal wealth was generally considered poor form, NZ as a whole was ranked by the OECD as the 3rd wealthiest country in the world in 1959.

This wealth was created in part by strong export commodity markets, but NZ suffered a perceived severe foreign exchange shortage. This economic paradox, which was a consequence of a Keynesian view of the world economic scene and an overvalued fixed exchange rate, meant that construction had to seek to minimise imported content. This translated to using as little steel as possible as all steel, even reinforcing steel, was imported.

Prestressed Concrete, which minimises the total steel content, thus had an initial unexpected competitive advantage that was not present in Europe where the concept was developing rapidly.

Prestressed Concrete started with power poles in 1953. Probably the worst possible use of prestressing. Why? Because prestressing is most efficient when it is used to counterbalance a constant load, normally self weight. Which is not the case for power poles. But power poles could be tested to destruction quite easily and they were indeed broken in great numbers to show again and again they were stronger and cheaper than the alternatives of wood, steel, or timber. This was very effective marketing and highly profitable business for the precasters of whom the leaders were led by Certified Concrete. These profits whetted their appetite for other uses of prestressed concrete.

A key figure now was Morley Sutherland (NZPCI President 1970 and 1971) an enthusiast with a passion for prestressed concrete. Sandy Cormack employed him to promote the concept of prestressing throughout NZ. This was a much harder job than power poles.

Why? The structures were bigger, could not be tested as easily, if at all.

New equipment and techniques were involved – jacks, grouting, anchorages.

The design concepts were demanding and uncodified.

The father of prestressing was Eugene Freyssinet. His disciple was a charming pear shaped tiny frenchman M. Yves Guyon. The only text book on prestressed concrete was Béton Précontraint by the same Yves Guyon. It was opaque in french, once translated it was impenetrable. So no codes, no tests, no texts, no experience. How could the Government engineers be convinced of its merit?

So, Sandy and Morley somehow got Yves Guyon to come to NZ. He had been to Sydney where he had been supervising the decentering by Freyssinet flat jacks of the Gladesville Bridge, at that time the longest concrete arch bridge in the world.

In that era much of the civil investment in NZ was in power projects. Somehow Morley learned of the penstock design for the Benmore power project. Somehow Yves Guyon was shown the traditional design of these major penstocks in thick steel plate. On a paper table cloth in a small restaurant he designed, using only his ink pen and slide rule an alternative in prestressed concrete. I remember Morley saying he went through four or five table covers with Morley carefully folding and preserving each one. His was a brilliant concept. I think a world's first. I

remember as a student seeing the precast penstock segments being constructed at Benmore in 1962.

I remember studying M. Guyon's handwritten ink calculations four years later in Paris. "Les Conduites Forcées de Benmore". It was a triumph for all, not least for the Ministry officers who accepted this alternative.

I remember dining with Monsieur Guyon and his wife in 1966 in his apartment on the Ile St Louis, just behind the Notre Dame. There were four of us – Peter Jensen who was the key note speaker here a few years later, was the fourth. I remember Yves' great affection for NZ and the thousands of books that occupied most of the space in his apartment, leaving little room for the four of us.

Other, highly innovative projects developed from the need to save foreign exchange. The mile long potlines at Tiwai Point were built in precast prestressed concrete – a world's first. I, as a young engineer, was responsible for this design but it was George Beca who saw the added value and pushed Comalco so hard that this technology was eventually accepted. And John Hollings for the massive concrete support structure for the Reformer Furnace at Motunui. These were success stories for the NZ concrete industry which aroused significant interest off shore. They also developed this industry's skills and resources and led on to other projects. My work included the 110 metre spanning PSC box girder for the NAC hangar at Christchurch (although this choice was partly because of its better fire resistance) and the Mangaweka and Rangitikei bridges which were much cheaper than the many steel alternatives that were studied. These projects and many others have been presented to this conference and attracted interest offshore.

It was Sandy Cormack's influence that led to the creation of the NZPCI in 1963, with him as Founding President. His strategy was to promote PSC by integrating the universities (teachers and researchers) the contractors, the suppliers of prestressing materials, the consulting engineers with the Ministry of Works and local authorities. To improve communication and the continual learning that he knew was needed for progress.

My first conference was not until 1968. Those early meetings in the 60s were, I suspect, not easy and certainly great attempts were needed for working relationships to develop. Bob Norman, the second President (1966) assisted this by his outgoing personality and his piano playing skills. I suspect much whisky and the Wairakei hot pool was also effective in building teamwork.

Slowly the conference, which was in those days the sole activity of the NZPCI, took form. Two figures now emerge. The first was JBS (Hans) Huizing who, although he never accepted the president's role, facilitated improved dialogue. He had a series of senior posts in the Ministry of Works and by the force of his personality improved communications to and from the MOW.

The second was Bob Park (President 1975, 1976) who, by his skills in teaching and research developed a sound intellectual basis for communication that played a major part in breaking down the old personal antipathies and intellectual barriers.

One of Bob's many crusades in the early 80s was the gathering of funds to purchase a 1000 tonne Dartec universal testing machine. He, just like those early power pole manufacturers,

realised that there was nothing like a well controlled test to destruction to convince the doubters as well as to improve understanding. And also – and this was his main aim – to educate us on just what concrete could achieve in the hands of experts. We were all only too happy to give Bob our support.

This was the start of a golden age in NZ engineering that Bob facilitated.

This conference became the yearly review of the advances in understanding in prestressed concrete and seismic resistant design. Remember, in those days structural steel was mandated for multistorey buildings. (Notwithstanding the foreign exchange they swallowed.) Many controversies and challenges were discussed. Was prestressed concrete sufficiently ductile? Were unbonded cables acceptable?

The conferences were then attended by enthusiasts, but the numbers were not large, and funding of the Society was marginal. But they were for me mandatory attendance.

I met, as a young engineer, all the leaders in the industry and learned from them their challenges and achievements. Many became valued colleagues and some close friends. This network, as it would now be called, was to me of inestimable value, both commercially and professionally. This same possibility exists for you all today.

Another important figure in those years was Rob Irwin. Initially he was an outsider for, as the representative of BBR, he was in direct conflict with the french connection, that of Freyssinet that Certified Concrete supported. I remember the complaints from Morley Sutherland when BBR as subcontractor to Wilkins & Davies won the coveted Thorndon Overbridge Prestressing contract. "Their price barely covers the cost of the prestressing steel" whinged Morley.

Rob's enthusiasm, commercial acumen and professional attitude as President of the NZPCI in 1973 and 1974 led the Society forward. I would wager that BBR under Rob's leadership did well on that contract and that Rob, like me, found this conference an important part of his professional and commercial calendar. In fact he still does as you will have appreciated from his presentation to you this morning.

Prestressing was, and remains for me, an intensely interesting engineering challenge. You know how it works. Two people come on site with a small jack and impart hydraulically enormous forces to concealed tendons of high tensile steel. The magnitude of these forces is hard to visualise. Easy to forget. On the 6th May 1975 these forces so redistributed the load on a well constructed falsework system for a motorway bridge near Karangahape Road that total failure of a span resulted.

And then the grouting machine pumps corrosion inhibitor around these high tensile tendons. This again can develop catastrophic failure through the applied bursting forces.

I remember well the Veale Road reservoir in New Plymouth. A reservoir, using precast panels of a standard size and smaller than the first reservoir of this type first promoted by Morley Sutherland many years earlier in the early 1960s. The execution of the jointing material which was dry packed mortar, was such that the high level of prestressing caused interconnecting cracks between some of the prestressing ducts. When the first grouting operation was performed, the cement grout acted like giant internal jacking fluid and imploded large slabs of

concrete. From the outside all looked well. From the inside it was a failure of staggering dimensions. To find the extent of these hidden internal cracks or delaminations as they were termed, the enterprising Council engineer commissioned a piano tuner to plot the "drummy areas" of the reservoir. A very strange sight – a piano tuner, up a ladder inside a reservoir, tapping concrete in otherwise total silence.

I mention these two examples of failures, and there have been many other such learning experiences, as your Society holds collectively an enormous wealth of knowledge that it is your challenge to retain, to communicate to future participants. Those who do not learn from history will surely suffer from its repetition. This is why education, knowledge management must remain an important part of your future activities.

The name of the Society was changed in 1989 to recognise the wider sphere in which it was now involved. In recent years the attention has moved away from prestressing and seismic engineering, understandably as knowledge in these areas was now much further advanced. Increased attention has been placed on durability, construction techniques, and on what might be termed architectural concrete.

When designed with skill and care concrete can form, not only the most impressive but also the most beautiful of structures.

In NZ we have not yet created the architectural marvel of Le Corbusier's Chapel at Ronchamps or Utzon's Opera House; but we have created iconic structures which have drawn appreciation and even affection from sometimes reluctant admirers. My personal experience leads me to think of the Sky Tower in Auckland and the Otira Viaduct as examples.

We have, however, created a professional construction industry which is envied by leaders in many other parts of the world. We are admired because we have avoided industry lobby groups, we have a culture of accepting public disagreement, of receiving and giving frank criticism, of direct communication; in a way that does not cause the irretrievable offence it might produce elsewhere. This openness has helped many develop as good engineers, teachers, practitioners in a way not possible in larger, wealthier countries. Our industry has developed well because your inheritance from your early leaders is the creation of this environment. It was achieved because many were prepared to devote a considerable amount of time and effort to the activities of this Society.

We did this through enlightened self interest. We benefited from it. We learned, we built life long relationships and we improved our businesses and institutions

Your society is an example of excellence that others should heed. You have

- been intellectually challenging
- had strong economic objectives
- pooled knowledge
- learned in a professional environment

This society will remain strong, relevant, indeed important, if you continue the same tradition.