



How C Lund & Son
responded to the
Canterbury earthquake:
See pages 4, 5 & 6.

Good aftershocks

Andrew and I both attended the Engineering School at Canterbury University in the early 1980s.

Prof Pauley, Prof Park and Nigel Priestly lectures covered compressive stress blocks for concrete confined by rectangular hoops (i.e. stirrups), ultimate deformation and ductility of members with flexure, hysteresis loops and plastic hinges. On September 4th it all came flooding back to us.

Well actually it didn't. The details of structural design, calculating seismic loads and analyzing structures under earthquake loadings from those days are probably long gone. What did come to mind were all our friends and colleagues who are practicing structural engineers.

The lack of damage to all the buildings that they had a hand in designing or strengthening speaks volumes. It is a tribute to them all. They have earned the respect of the whole world overnight. They deserve it.

There have been moments over the years when the construction industry and structural engineers in New Zealand have put each other to the test. In new buildings it seemed that the reinforced concrete construction detailing for seismic design was getting more and more difficult to achieve.

The stirrups have become even more closely spaced and more difficult to fix. Concrete in beam and column joints almost needs to be placed in spoonfuls in order to get it where it needs to go. Grouted drossbach ducts have to be placed with millimetre accuracy. Concoctions specified in concrete are constantly evolving, making it more difficult to handle and slower to harden. Some laps and development lengths detailed for reinforcing in columns have actually become impossible to achieve, and the design office has had to go back to the drawing board.

Strengthening of older buildings is hard work. It involves working in existing spaces that are often small and difficult to access, heavy materials have to be handled by hand, and drilling for connections to existing structures can take days and days and days.

But it has all been worth it. Not only has all this effort saved buildings and the fabric of our community. It has literally saved lives.

We hope you all have a relaxing holiday break and get to spend some special times with your family and friends.

Jo and Andrew Macgregor and Wayne Radburn



C. LUND & SON LTD
Builders • Joiners • Contractors

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City Mission draws on C Lund and Son's STRENGTHS

The ethos of the Christchurch City Mission is that although the people who use its services are the recipients of charity, they deserve dignity, respect and decent surroundings.

C Lund and Son's acknowledgement of these values was one of the factors that won them the contract to build the City Mission's new social services centre.

Work on the new facility began in November. It is located directly across the street from the Mission's existing facility on the edge of the central business district.

City missionary Michael Gorman says the Mission runs a variety of support services and short term residential programmes at its facility.

"We provide a number of social services for men and women. These include social detoxification units, where we try to create a stable environment for people struggling with alcohol and other drugs," Michael says.

"We also have a men's night shelter where we provide dinner, bed and breakfast for 27 men each night. Five nights a week we also provide supper for another 30 men.

"Other services include a food bank, a women's day centre, a referral and support service for people dealing with other agencies such as Work and Income, a budgeting service, and nine opportunity shops."

The Mission's current facility is a rambling collection of aging buildings. Five years ago it began planning and fundraising

to build a new one.

"It costs us \$3.8 million a year to run the Mission. About 20 percent of that comes from contracts with the Canterbury District Health Board and other agencies. The new facility will cost an additional \$6 million.

"We needed the new centre because the old one is expensive to maintain. Our staff are now scattered in various buildings, which raises issues of safety. Also community standards have changed, and while we do not want to be opulent, we believe our clients deserve a decent environment," Michael says.

The new Mission complex is a two storey building with a basement that is designed to look like three separate buildings. It will house all the existing services with room for a few more beds for the shelter and detox unit.

It will also provide an opportunity to revamp the old site in order to give more prominence to its heritage chapel and provide more storage and additional services, such as a women's emergency night shelter.

Site foreman Brad Sheriff says the contract to build the City Mission is a good one for C Lund & Son. It draws on all the company's strengths and provides work for the precast and joinery divisions as well as for builders.

The front facades of the precast units require a special finish and plans are being made to use fibre glass moulds to achieve the desired look.

Lincoln Community centre

Site foreman John Taggart says building Lincoln's new community centre for the Selwyn District Council is just the kind of project C Lund & Son builders like.

"It is a big job with a lot of work at heights on scaffolds. It gives the boys something to get their teeth into. There is something different to do every day, unlike big multi-storey jobs where you do the same thing on many floors," he says.

True to its name the new Lincoln Community Centre, will provide the community a venue to hold a host of events. It has facilities, including changing rooms and showers, for a wide variety of sports and performances. It also has a number of meeting rooms, kitchens and bars.

The entire building is 62m x 51m with a large part of it taken up by the 41m x 28m sports stadium. The stadium has bleacher seating and will be used for basketball, netball and other indoor sports.

At one end of the stadium, bi-fold doors will separate off a smaller area that is designated for martial arts and indoor bowls. It also has a performance stage.



Placing the lift well is one of the first steps to building the Christchurch City Mission's new social services lift.



comes together

The ceiling of the sports stadium is built in three levels, above the bleachers it is 6.5m high, above the outer rim of the play area it is 8.5m high, and in the centre it rises to an 11.2m high skylight. The sports hall can hold up to 685 people at a time while the entire facility can hold 1000.

John says work on the community centre started in February 2010 and is on schedule to finish in March 2011. For most of the project eight to 10 C Lund & Son builders have been on site and that includes a busy team of C Lunds & Son scaffolders supervised by Brian Spencer.

At the peak there were 35 subcontractors were at work on the community centre. Among the specialty tradesmen who will be called upon for the job are a team from Auckland who will lay the sprung wood floor in the sports stadium. They will also do the court marking to delineate the play areas.

With building technology constantly changing, most construction jobs have an element or two that is new. In the case of the Lincoln Community Centre it is XpressClad negative detail cladding. John says XpressClad is glued to aluminium rails and makes an attractive cladding for the front entrance.



Above:- Foreman John Taggart said the Lincoln Community Centre is just the type of large building the company's builders like to work on.

Left:- C Lund & Son's scaffolders had their hands full during the construction of the sports stadium at the Lincoln Community Centre.

Precast team behind *stylish* new carpark

These days most large-scale modern buildings are built with precast concrete panels, and, with years of experience, C Lund & Son's precast operation is quite adept at pouring highly technical panels.

The new \$4 million multi-level car parking building the company is building for the Timaru District Council threw down a new challenge for the precast team however – some very large panels with a surface of bluestone aggregate.

C Lund & Son draughtsman John Wilson says the Timaru car park was a big job for the precast operation. The 50m x 37m x 10m building required 72 wall panels, 17 spandrel panels, five precast landings for stairs, and 13 columns.

"The job required some tricky pours with lots of reinforcing but that is now typical of modern high-tech buildings. The engineer's drawings called for some very large panels. The largest was 14m x 4.5m," John says.

"In the original plans some were even larger. We had to go back to the engineer for the project, Alan Reay, to cut some of them down because they were too large to transport. We did have to pilot the largest ones when they were transported down to Timaru.

Precast foreman Phil Brook says the nine exposed aggregate panels were something a bit different for his team and created their own challenges. The bluestone surface is on one face and one edge, which meant they had to be done in two pours. A number of trials were carried out and a prototype standard of finish agreed with the engineer.

"The bluestone aggregate was laid out in a 'consistently random' pattern on a bed of sand. Then the concrete was poured on top of the sand so the aggregate would create the surface.

"Once they set, we water blasted them to remove the sand. The concrete behind the bluestone was coloured so it is darker than normal to match the stone," Phil says.

Site foreman Mick Leonard says the precast team did a really good job with the bluestone panels, and they make a very attractive façade along Sophia Street.

Mick says as of early December, the basement and ground floor levels of the parking building were in use, and the Lunds team of builders was building the ramps that will link them with the upper levels.

Six Lunds builders were on the job from the beginning, and the company's 150 tonne crawler crane was set up to install the panels.

"The only problem we faced was when we had to link into the existing lift shaft and stairs in the Farmers building. They are out of square, and we had to follow along with them. We don't really like building things that aren't square," Mick says.



A unique feature of the Timaru carpark is the precast exposed bluestone panels for its facade.



The multi-story car parking building in downtown Timaru was a major job for the C Lund & Son precast unit as well as builders.

C Lund & Son well equipped to deal with quake aftermath

Thanks to C Lund & Son, the Sumner restaurant 'Ruptured Duck' was less ruptured in the Canterbury earthquake than it might have been.

"The owners of the restaurant were one of the first to ring us," says C Lund & Son general manager Andrew Macgregor. "The fact that we got the building temporarily supported straight away probably prevented it from falling apart in the big aftershocks."

C Lund & Son crews were more than a little busy in the days after the quake. "We had the heavy equipment, temporary support systems and cranes on hand so we could respond to emergency situations. Each of the jobs we did had its own unique challenges," Andrew says.

A good example was the emergency propping Lunds did for Our City O-Tautahi, which is housed in the historic Queen Anne building on the corner of Worcester Boulevard and Oxford Terrace.

Because it is a heritage building, damaged walls had to be supported without drilling into them. To hold up a multi-storey chimney, the Lunds crew used a substantial four sided steel truss from its yard that has been used for a 'million different things' over the years. It was held in place with 'slim soldiers' anchored to large concrete blocks.

Another big job was propping up a cold store at the Polar Cold plant in Sockburn. During the quake, large racks of frozen food collapsed inside the cold store. They fell against an exterior wall that threatened to collapse.

Andrew says one of the trickiest buildings to deal with was the St Marys Anglican Church in Merivale. The earth subsided along the base of one of the church's walls, causing a crack to appear at the base of a row of stained glass windows.

Andrew who is a structural engineer himself, was able to work with St Mary's own structural engineer to come up with solutions that meant work could start

without delay.

"Then we ran vertical timber walers up the outer wall to minimise damage to the stone and provided support using a steel scaffold truss system. We also temporarily supported the interior roof as a precaution in the case of further movement."

C Lund & Son crews also removed many chimneys and secured several double skin brick and stone homes, including the vicarage at St Marys and Ohinetahi at Governors Bay.

Andrew says now that the emergency response work is done largely it is now a matter of waiting for the engineers' reports and consents to be complete before the rebuilding work begins.



Randolph Apartments



Catholic Basilica



C Lund & Son used shipping containers, props and huge concrete blocks to bolster the walls of Polar Cold's chiller.



Interior and exterior supports were used to shore



Heritage Hotel Christchurch



Catholic Basilica

Seismic strengthening worked when it counted

The Christchurch earthquake brought plenty of destruction but it also had a very positive message – earthquake strengthening works.

Over the past two decades C Lund & Son has undertaken earthquake strengthening on a number of Christchurch landmarks, including the Anglican and Catholic Cathedrals, Hagley Community College, the Malthouse Theatre, Avonside Girls High School a number of facades in the central city and the Old Government Buildings. Virtually all of them came through the September 4th quake with little or no damage.

C Lund & Son general manager Andrew Macgregor says while each job is different, seismic strengthening generally entails adding shear walls to strengthen existing walls and stiffening floors so they act as diaphragms. Together the shear walls and floor diaphragms transfer lateral loads away from the original walls.

When strengthening historic double or triple skin brick buildings, one or more layers of the brick can be removed and replaced with poured or sprayed concrete skin walls to maintain their original appearance of the exterior but add considerably more strength.

In strengthening Christchurch Anglican Cathedral in The Square, for example, shear walls were hidden behind limestone blocks to blend in with the existing walls. A lot of work went into stiffening the roof, and steel bracing was added to the timber roof structure. The roof was removed and reinforcing was inserted into the outer stone walls. Those walls were then topped with concrete beams and the roof was restored.

Cathedral administrator Chris Oldham says the strengthening took place in two stages in 1999 and 2002 and brought the building up to near 67 percent of the modern code.

"It meant that the earthquake caused no structural damage at all. We could have opened the day after the earthquake but out of caution we didn't. Some mortar fell from the pointing in a few places and there is some superficial damage above the rose stained glass window above the entrance but it poses no danger," Chris says.

The neo-classic Catholic Cathedral of the Blessed Sacraments in Barbados Street was a potentially more difficult building to secure with its two large towers in front and large dome above the altar. The strengthening work that C Lund & Son carried out included concrete skin walls in the dome, the two

towers reinforced with horizontal concrete beams as well as steel verticals and diagonals, and overlaying a structural concrete floor to the existing mezzanine floor. Parapets and other non structural elements at roof level were also seismically restrained.

Structural engineer Grant Wilkinson worked with the Holmes Group, which designed several of major strengthening jobs C Lund & Son carried out and he now works as an independent consultant specialising in structural design and seismic strengthening.

Grant says while the Cathedral did suffer minor damage, the seismic strengthening worked well. "Without it, there is no doubt the dome would have fallen into the altar area, and the bell towers would have collapsed."

Andrew Macgregor says strengthening Hagley Community College and the Old Government Building in The Square (which now houses Randolph Apartments at the Heritage Hotel) were similar in that they virtually entailed constructing new buildings inside the skin of the old one.

"For the Old Government Building we also added new skin walls and floor diaphragms. In that case, we actually added two new four-storey concrete shear blocks in the core of the building. The core blocks are extensively piled and the old building is tied into them. The new cores contain 12 of the building's apartments."

On a smaller scale, in 2008 C Lund & Son carried out seismic strengthening on Christchurch's Malthouse Theatre. This nearly 150-year old two storey stone building sits close to the Heathcote River but it too suffered virtually no structural damage.

Kathy Beswick is manager of the costume hire business that is housed in the Malthouse. Kathy says though some racks of costumes jiggled their way across the floor, none of her extensive collection of costumes, hats or wigs fell onto the floor. "If we had not done the strengthening we would be looking at a pile of rubble," she concludes.

C Lund & Son have worked with some passionate structural engineers and people like Sir Miles Warren and the late Bill Fox on strengthening projects. Bill Fox could be very persuasive when it came to worthy causes. The Christchurch City Council partially funded many projects. Everyone involved including the building owners deserve acknowledgement for the tenacity and foresight it took to get Earthquake strengthening work underway.



Adding concrete skin walls behind the facade was a major element of seismic strengthening at Hagley Community College.



Structural steel was added to strengthen the roof of the Malthouse Theatre.



Thanks to seismic strengthening carried out by C Lund & Son the Christchurch Cathedral survived the earthquake unscathed.



Avonside Girls High School



Hagley Community College

Making Manapouri safer

A small team of C Lund & Son Ltd builders has spent the last four months carrying out a job deep underground in the heart of one of New Zealand's monuments of civil engineering, the Manapouri power station.



At work in one of the cable shafts.

The hydro scheme uses seven generators in a cavern excavated from solid granite rock 200m underground to produce electricity from water siphoned out of Lake Manapouri. Access to the power station is via a 2.5km spiral vehicle tunnel.

Earlier this year, C Lund & Son won a contract from Meridian Energy to enhance fire protection in the generator hall and in two long tunnels that provide access to the cables that bring power to the surface.

Foreman Wayne Collins and carpenters Tim Fry and Andre Stevens have been posted to the job. They stay at the Meridian hostel and work a roster of 10 days on, four days off to carry out the work. All staff involved in this project undertook additional training in order to meet Meridian's very high health and safety standards.

C Lund & Son quantity surveyor Matt Shankland says the team had to replace 43 doors with fire rated doors and create 'fire cells' where anyone caught up in a fire could congregate and move to safety.

"The builders worked on a number of fronts. They added fire

rated walls around the entrance to the egress stairways in the generator hall to fully enclose them. They built fire rated walls to create a similar safe gathering point at the entrance to the elevators.

"They also added walls and doorways in the corridors to create fire cells. The cells are designed to block the fire long enough for people to get out. The walls are rated to withstand fire for an hour, and each cell has an exit hatch," Matt says.

Similar fire cells have been

added to two horizontal corridors above the generator hall that provide access to the cables. The corridors are another feat of engineering, roughhewn out of rock.

The specialist fire doors are stainless steel with a timber core and steel door frames, and the walls are timber framed, lined with fire resistant Toughline GIB, many fire pillows have been installed around trunking for electrical services and controls.

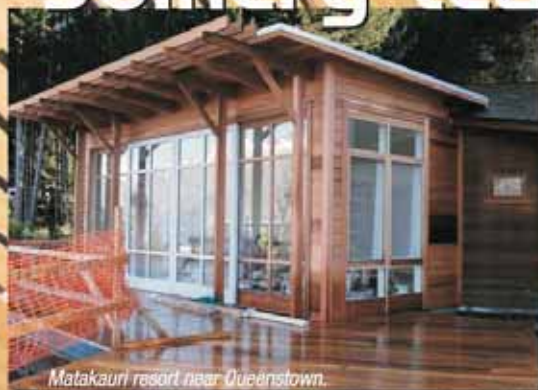
The only means of delivering materials to Manapouri Power Station is by a weekly barge.

The logistics of arranging deliveries was a collaborative effort with Meridian and was well thought out. There is no jumping in the ute to go to the nearest supplier when working at Manapouri Power Station.



Builders working on fire rated doors in the generator hall of the Manapouri power station.

Joinery team IN DEMAND both north and south



Matakauri resort near Queenstown.



Cedar windows for the exclusive Matakauri resort near Queenstown.



Lund's joinery prepared and installed the joinery in Air New Zealand's new offices at Christchurch Airport.

Along with a number of large projects in Christchurch, Lunds Joinery turned its attention to several major contracts in the south this year.

The largest of the southern jobs was the fitout of Presbyterian Support Otago's (PSO) retirement village in Wanaka. The village is made up of 14 two-bedroom stand-alone villas and eight one-bedroom apartments in a two-storey building.

Lunds Joinery manager Glenn Chittock says the joinery team made and installed all the joinery for the village, which included kitchens, bedroom wardrobes, vanities, and shelving in the lounges and laundry.

"Much of it was in veneer board made of Southland beech finished with a spray lacquer," Glenn says. "We did a number of other jobs in Central Otago as well."

"They included timber windows and doors for the up-market Matakauri Lodge near Queenstown. We also made the timber windows and doors and interior joinery for a new church hall in Arrowtown. The hall is an addition to a historic church so the exterior is designed to be in keeping with the old church while the joinery in the interior is all modern melamine."

One assignment down south has led to more work for Lunds Joinery up north. The Timaru

joinery plant put together an Air New Zealand self check-in kiosk for Queenstown airport and that has led to an order for more of the kiosks for the new terminal at Christchurch.

"We are doing quite a bit for Air NZ at the moment," Glenn says. "We did the joinery for their refurbished hub offices at Christchurch airport and we are making an elaborate 1200 sqm plywood ceiling for their lounge at the new regional terminal there."

"The ceiling is made of decorative curved and slotted panels which are installed in slopes at angles up to 45 degrees. It is made up of 600 sheets of board and 400 of them had slots

routed with our CNC point to point machine. It took us three months to machine all the parts."

Another big job Lunds Joinery handled in Christchurch this past year was to provide joinery for the new technology block at Burnside High School. The order included lab benches and whiteboard units as well as general joinery.

Of course, the joinery team has been an important part of the major construction projects C Lund & Son has undertaken. It provided the joinery for the fitout of the expansion of the Hellers Tasty plant and staffrooms, and the Biological Sciences building at University of Canterbury.

Covered!

Insurance Broker Key
Member of Lund Team

Relationships are very important for C Lund & Son, and one of the company's longest standing relationships is with insurance broker Kay Thomas.

Commercial construction is an expensive and potentially dangerous industry so being covered with adequate insurance is vital. For more than 20 years Kay has worked with C Lund & Son to insure all aspects of its operations.

Kay is a Christchurch-based account manager with the global Aon Corporation. Kay says many of her colleagues have specialised in one industry or one aspect of insurance. She prefers to be a general account manager and deal with the day to day issues that arise with her clients.

"I have built up my own pool of commercial clients over the years, and the best part of being in the Aon Group is that if I need a specialist or a technical expert, I can call them in."

"My clients are across the board in wide variety of industries – food manufacturers, honey producers, jewellers (including a paua pearl producer), motor vehicle dealers and cartage contractors to name a few. You get to know them and their families and understand all the various aspects of each business. This is what makes the job so fascinating."

Kay says C Lund & Son insures all its plant, motor vehicles, cranes and other equipment and has full liability coverage.

"When Lunds put in a tender, they have to insure against anything that could go wrong during the building process, whether it is fire,

Kay Thomas and Wayne Henderson.

flood, burglary or other accident. It is my job to get the wording right for what is needed, then go to the insurance market to get the best price."

"Andrew and Jo are wonderful people, and their team is great to work with. We need a lot of information to put together tenders for large construction contracts, and they are very good about providing it."

One of the more challenging jobs Kay worked through was to insure Bruce Lund when he decided he wanted to enter his yacht 'E.Z. Street' in the Sydney to Hobart race. It was the year after the disastrous 1998 race when a severe storm knocked out more than half of the boats and killed six people.

"That year all the insurance companies were being very cautious. None of the Australian companies would insure Bruce because he was not an Australian, and none of the New Zealand companies wanted to insure him because of the history of that particular race. We had to get someone to change their mind. Eventually we did."

A new employee to Aon, Wayne Henderson, has recently joined Kay to assist with the Lund Insurance programme. It turns out Wayne is already familiar with C Lund & Son because he has a family connection to the company. His father-in-law is retired long-time builder and C Lund & Son foreman Bill Caldwell.

Farewell to Colin



C Lund & Son sadly said goodbye to one of its own this year. Builder Colin Hunter passed away suddenly in May 2010.

Colin had been working with C Lund & Son for about five years. Based in Timaru, he worked primarily as a foreman with the building team but had recently managed a number of joinery installation projects with the joinery division.

Colin was a highly skilled and hardworking tradesman. He had made significant

contributions to all the projects he had worked on throughout his career. A man of few words but with a real passion and drive for the job at hand, Colin is sorely missed by the C Lund & Son team.

Outside work, Colin was a keen and accomplished lawn bowler and an avid motorcyclist. His funeral was well attended by his many friends, family and all Timaru C Lund & Son staff.

Key men mark milestones

Three key C Lund & Son employees have chalked up long-service milestones this year, and the company is acknowledging their contributions.

Construction supervisor Stephen Mouat, foreman Shane Gwynne, and joinery draughtsman and production technician Andrew Patterson have all been with C Lund & Son for 20 years and will receive watches to mark the fact at the Christmas function.

Stephen currently assists with construction management at several sites in both Timaru and Christchurch. Steve was the project manager at the recently completed University of Canterbury Biological Sciences Building and was site manager for the seven storey IRD office block project.

Steve served his apprenticeship with C Lund & Son and has worked at many large Lund projects including Dunedin Police Station, Christchurch International Airport and the Christchurch Art Gallery.

Shane has served as leading hand and foreman on a number of major C Lund & Son projects including the Randolph Apartments, Christchurch Art Gallery, Terrace Downs Resort, and Christchurch Men's Prison. He was also fitout foreman at the UC Biological Sciences building and served as foreman at several construction, alteration and fitout projects in Christchurch and Ashburton.

Andrew Patterson currently operates the three

dimensional drafting programme to prepare the drawings for the items produced by Lund's Joinery. With Graham Smith and Mark Webb, Andrew is a part of the team responsible for production at Lund's Joinery. Andrew worked his way up to the position from the floor of the joinery shop.

His first jobs were in the paint booth and driving the joinery department's truck. He worked on joinery in his spare time and eventually moved into joinery production.

For many years he operated the CNC point-to-point machine used to fabricate components for joinery. Three years ago Andrew moved from the shop into the office to learn another new skill – operating the 3D drawing software.

On behalf of everyone at the company, Joanne, Andrew and Wayne thank Steve, Shane and Andrew for their continued support and commitment to C Lund & Son.

They do the hard stuff with a smile and make it look easy when we all know it's not that easy. When you think about the collective experience of Steve, Shane and Andrew, what they know, what they can do, what they have achieved working collaboratively with everyone and leading our projects, it's immense. We are very lucky to have them.

Social club gets adults and kids on deck

By standards of recent years C Lund & Son had a fairly quiet social life in 2010.

The main outing for the social club in the first half of the year was an evening cruise on Lyttelton Harbour in the vintage steam tug 'Lyttelton'. After the cruise, everyone hopped on a bus to the Greek restaurant Costas Taverna to continue the festivities.

Sunday October 31st (Halloween) saw the social club holding a family picnic day at The Groynes. There was plenty of fun with a bouncy castle, paddle boats, canoes, balloons, a lolly scramble and bubbles (one assumes there were the types of bubbles that would interest both young and old).

The picnic was a chance for the baby boomers to show off their own babies. A lot of kids were on hand with the majority in the four-and-under age group.

The social club's theme turns adult once more in the new year. A pub games night is scheduled to test the mettle of Lund socialites as they play darts, shoot pool, and make themselves look silly in other ways.



The social club took a cruise on the tug Lyttelton.



Steve Mouat

Shane Gwynne

Andrew Patterson

NZ's leading edge building designs unmoved by shake

Modern buildings are designed to withstand earthquakes, and as the magnitude 7.1 Canterbury quake showed, they do so very well.

New Zealand has been at the forefront of international efforts to engineer earthquake-proof reinforced concrete structures. Much of the credit for this goes to the graduate programme at the Canterbury School of Engineering's Department of Civil Engineering.

Professor Bob Park, Professor Tom Paulay and latter Dr Nigel Priestly, were experts in the field of seismic design, and they were based at Canterbury University from the late 1960s to the late 1980s. They were all talented and entertaining lecturers in the field of structural analysis and structural design and they led the graduate research programme at that time.

They trained many very competent structural design engineers, and their research has been nationally and internationally recognized. New Zealand currently has the highest standards of structural engineering particularly in the area

of seismic design as a result.

In the late 1960s seismic design was in its infancy and there was an opportunity to improve how concrete construction could provide ductile structures that could resist seismic loads.

A major incentive for this research at the time was the construction of the Bank of New Zealand building in Wellington. There were too many uncertainties for the consultants to design the BNZ building using reinforced concrete so it was built in structural steel.

Study Groups of researchers and practitioners were set up to draw ideas together. They helped develop the pioneering reinforced concrete NZS3101 design standard published in 1982. This provided structural engineers with new guidelines so they could confidently design buildings and structures in reinforced concrete for earthquake loadings. It was the product of collaborative efforts of the Canterbury University researchers and structural engineers in New Zealand, North America and Japan.

Structural engineer Grant Wilkinson

specialises in seismic design and strengthening. Grant says another New Zealand contribution to the field was the brainchild of Dr Bill Robinson, who is based in Wellington. His innovation is base isolation systems of rubber, steel and lead that prevent the energy of earthquakes from reaching a building.

In some cases, these base isolation bearings can be used to strengthen existing buildings. The NZ Parliament building is a notable example. But they are mostly used to strengthen vital new buildings such as hospitals at levels up to 160 percent of code.

Grant says when it comes to strengthening historic masonry buildings the techniques continues to be those C Lund & Son has used in Canterbury for the last two decades: stiffening existing floors and masonry walls, installing shear walls, and tying the building together to increase its basic integrity.

Some new composite fibre products are available to create skin walls but they are used mainly to strengthen existing concrete buildings rather than masonry ones. Because they are thin (1mm-2mm) fibre glass or carbon fibre composites do not allow reinforcing dowls to be added to historic masonry, whereas this can be done when the reinforcing skin is a 150mm layer of concrete.

C Lund & Son steps in when sky falls on Tegel Chicken

While there was an initial rush to stabilise and in some cases demolish damaged buildings, the pace of rebuilding in Christchurch after the earthquake has been slow.

Not so for Tegel Foods. With its chiller and cold store both extensively damaged, the chicken processor got in touch with C Lund and Son immediately after the quake.

The initial order of business was to prop up and stabilise the existing cold storage facilities so the food products would not spoil. The next was to build replacements...quickly.

The first result of this effort was a new 710 sqm chiller that a C Lund & Son crew built in just six weeks.

C Lund & Son quantity surveyor Wayne Radburnd says the construction team began setting up to build the new chiller on October 14th and handed it over to Tegel on December 6th.

Before it was finished, work had already begun on the larger 1250 sqm cold store, which is due to be handed over in April.

Wayne says both buildings are constructed of structural steel with a cladding of insulated, fire-proof Kingspan panels.

"It was a typical fast track job with men working long hours and details constantly evolving as we went along," Wayne says.

Site foreman Rex Jellef says the new chiller is actually an extension of the old chiller. Where the new structure connects to the old one, Lund builders put up temporary walls so the existing refrigeration system could be kept running.

"Once the building is complete and the new area is chilled down, the wall separating them will be removed to create one large chiller," Rex says.

The C Lund & Son steel shop and Pegasus Engineering manufactured and installed the structural steel for both new buildings, working over weekends to meet the fast track programme.

Wayne says the cold storage is a somewhat more involved job because it has a double slab refrigerated floor. A concrete slab will be poured, pipes for glycol refrigerant will be laid on it, and then another slab will be poured on top of that.



Dave Cronin, Nick Thomas, and Phil Brook install the last precast panel in the firewall of Tegel's new chiller.