CONCRETE STRUCTURE INVESTIGATIONS LTD

ACCURACY · INNOVATION · INDEPENDENCE

Accuracy - Innovation - Independence

Concrete Structure Investigations Limited

Capability Statement

2023

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Background

With a lot of research, trial and error, and a whole lot of commitment, CSI was born in mid 2013.

It started with a team of 2, scanning buildings throughout New Zealand, assessing structural strength/ weakness and where they found weakness, the cause of it. As time passed, it was obvious there were much needed improvements to be made in the construction industry. Instead of settling for the generic and ordinary, they did their own in-depth research to maximise the capabilities of the scanners, to get the results they wanted and that no one else can get.

They have grown to a quality team of 18 (including a few part-time staff) with each person highly respected in their field. They are proud to deliver high quality results using the best tools on the market, and to offer services that their customers can only get with CSI.

They are continuing to apply both their scientific and engineering expertise to develop technologies which enable them to stay ahead of competitors. They are excited for the future of non-destructive testing and their leading role in the field.

Snells Algies Pipe Bridge

Working on the Snells Algies Pipe Bridge became a great experience because it was the first time CSI took on a project that required nearly all the services CSI provides. They are used to working on a wide variety of structures but on this job, it was their first time deep in mud!!

What CSI does

The purpose of the business is to provide analysis and assessments of steel reinforced concrete structures. These services are provided to building surveyors, consulting engineers, building owners and related construction and civil works companies.

For consulting engineers, building surveyors and building owners, CSI:

- carries out verification of steel reinforcing and concrete composition in concrete buildings.
- supplies full reports including marked-up plans, photos and scanned images and associated data.

For construction and civil work companies, CSI:

- scans beams, columns and slabs for reinforcing hit prevention.
- offers an extensive range of non-destructive testing methods.

CSI changed the face of scanning through extensive research and expert application and worked hard to change the preconception of the technology held by engineers and property owners.

CSI investigates what would be useful to their clients in the non-destructive testing space through market research.

CSI continues to offer clients new technologies in non-destructive testing and operates to international standards when gathering and reporting data crucial to decisions on building/infrastructure upgrades.

As well as Scanning, CSI also now offers Rebar Corrosion Determination and Corrosion Control, Pile Integrity Tests, Material Tests, Corrosion Condition Surveys, Crack Monitoring, Anchor Testing, Pull-off Strength Tests, Ultrasonic Testing, Structural Health Monitoring, URM Testing and QA.

CSI is determined to continue as leaders in their field through innovation and educating the industry as to what is possible. CSI is well respected by the current customer base and are known for going the extra mile to provide value to clients.

Textile Centre

Working on this heritage building located in Auckland is CSI's largest heritage job to date. They worked on this project for months doing extensive and detailed investigations.

The market

CSI's initial focus has been on the New Zealand market. Since commencing business in August 2013, CSI has built an already extensive database nationwide of 4000+ engineers (civil and structural), property owners and government institutions who could potentially use its technologies.

But CSI has no intention of stopping there. They believe there is a need for their technologies throughout Australia as well, and further afield. CSI are now pricing for jobs in the Asia/Pacific region.

Consulting engineers make up much of CSI's business.

After that come:

- civil contractors;
- building owners;
- government institutions;
- the construction industry.
- And building surveyors

CSI is working in collaboration with other New Zealand companies on potential overseas contracts.

Premier Building, Queen St, Auckland

CSI did a seismic assessment for consulting engineers. Thisis now a retail and office space.

Competitive advantage

CSI offers the most expert and comprehensive service for concrete scanning throughout the country. Additionally, CSI has added ground-breaking non-destructive testing technologies such as Pile Integrity Tests, Ultrasonic Testing and digital crack monitoring and reporting and will continue through research and development to investigate and implement new technologies as mentioned previously.

Customers

CSI's current marketing reach is consulting engineers, civil engineers, architects, civil contractors, councils, building surveyors and building owners and construction companies.

Currently CSI has approximately 700 companies as its customers.

The customer base continues to grow strongly and because each 'customer' is actually an organisation, CSI is used by many different professionals within each organisation.

Top 15 customers

Stiles and Hooker Ltd	Wellington Airport
CRL Construction Limited	Auckland Transport
CMP Construction Limited	Martinus Rail
Naylor Love Construction	LT McGuinness
Auckland Council	Black Interiors Limited
Robert Cunningham Construction	LCO Domain Ltd
Livefirm Construction	GHD Limited
Ryman Healthcare	(quite a lot for Body Corps)

Reinforcing Verification Reporting

CSI provides non-destructive structural analysis for locating reinforcing bars, pre-tensioning tendons, plastic pipes, electric cables and cavities in concrete at depths of up to 300mm.

Pricing

6.

CSI Rates are built up using hourly charge-out rates multiplied by standard labour constants.

These have been developed from past experience using back costing and the like from historic projects.

To this is added any material, subcontractor, travel, access pricing (estimating) and other such costs.

The final pricing element relates to overhead, with margin determined on a case by case basis.

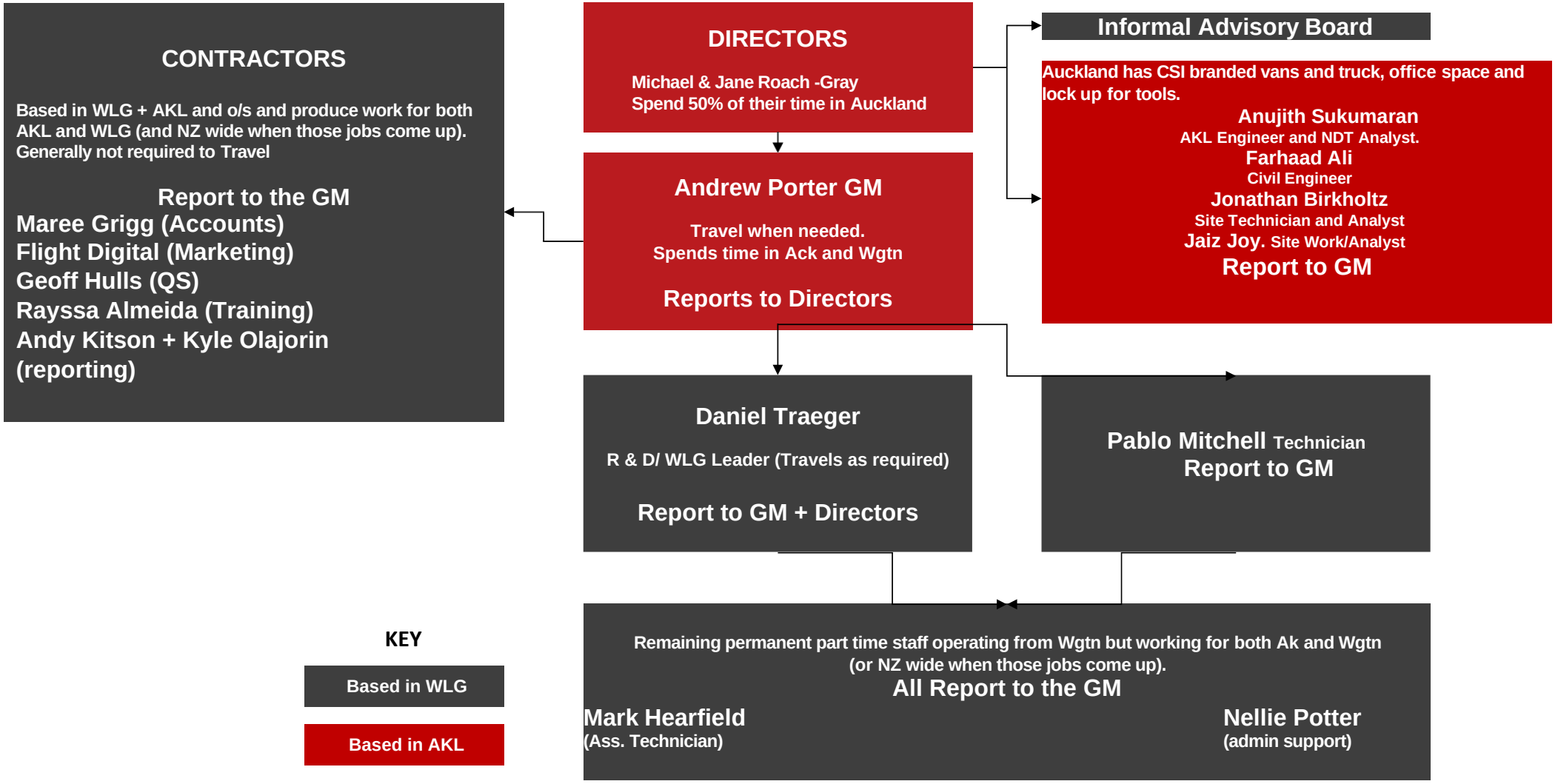
For urgent, large, small or more complex jobs we revisit the constants, rates, pricing, margin etc.

This would also apply for large, ongoing jobs where costs to CSI would be reduced due to continuity and the security of the ongoing work.

Auckland Wharves

PIT testing at Auckland Wharves.

The CSI Team


CONTRACTORS
Based in WLG + AKL and o/s and produce work for both AKL and WLG (and NZ wide when those jobs come up). Generally not required to Travel
Report to the GM
Maree Grigg (Accounts)
Flight Digital (Marketing)
Geoff Hulls (QS)
Rayssa Almeida (Training)
Andy Kitson + Kyle Olajorin (reporting)
DIRECTORS
Michael & Jane Roach -Gray
Spend 50% of their time in Auckland
Andrew Porter GM
Travel when needed.
Spends time in Ack and Wgtn
Reports to Directors
Informal Advisory Board
Auckland has CSI branded vans and truck, office space and lock up for tools.
Anujith Sukumaran
AKL Engineer and NDT Analyst.
Farhaad Ali
Civil Engineer
Jonathan Birkholtz
Site Technician and Analyst
Jaiz Joy. Site Work/Analyst
Report to GM
Daniel Traeger
R & D/ WLG Leader (Travels as required)
Report to GM + Directors
Pablo Mitchell Technician
Report to GM
KEY
Based in WLG
Based in AKL
Remaining permanent part time staff operating from Wgtn but working for both Ak and Wgtn (or NZ wide when those jobs come up).
All Report to the GM
Mark Hearfield
(Ass. Technician)
Nellie Potter
(admin support)

Michael Roach-Gray
Director
Ex Construction Project Manager
Ran Roach Construction Company in the 90's

Michael's key skills, expertise and focus, are to develop and provide investigative services into concrete structures for Structural and Civil Consulting Engineering companies; resulting in Consulting Engineers saving their clients time and money in the process of remedial design or seismic upgrading of existing steel reinforced concrete structures. Michael is results-driven in the quest for the continual development of processes and techniques, research and development to enable CSI to provide their Consulting Engineering clients and end users to find answers quickly, in a non-destructive manner. Michael's background, after running his own construction company, is commercial construction where he was for many years a contract project and construction manager for Matrix Consultants Group Ltd.

Andy Kitson
Consultant (qualified Surveyor)

Kye Olajorin
Consultant (qual. Structural Engineer)

Andrew Porter
Auckland/Wgtn based General Manager
Ex Business Owner

Andrew first qualified as a lawyer, and spent some time working overseas in that capacity. He has since managed Quest Hotels, run a Body Corporate Management Company and a Residential Construction Company. He has a wealth of experience in managing Small to Medium Sized Enterprises (SMEs).

Jonathan Birkholtz

Auckland Site Technician and Report Writer

Jonathan is a qualified Non-Destructive (Steel) Technician he has a BCom degree as well as 4 NDT (level 2) certificates and an international welding inspection certificate.

Jane Roach-Gray
Executive Director, Marketing
Ex marketing and teaching

Jane has previously successfully run her own business and loves the challenges associated with a growing industry. Jane is a skilled organiser. Her numerous responsibilities include overseeing Human Resources, capital raising coordination, marketing, assisting on-site, and involvement with all areas of management and administration.

Flight Digital
Marketing, Media and website
Creativity, Technology and Strategy

Flight Digital assists through three key services; digital platforms, strategy and creative. Flight Digital's capabilities and services include (but are not limited to) marketing and communications, strategy, search engine optimisation, graphic design and art direction, website design and development, e-commerce development and content production

Maree Grigg
Accounts Administrator
Worked in Accounts for Construction previously

Maree has been working for CSI part time since 2013, looking after the accounts and wages for the staff. It's her role to ensure CSI's accounts are up to date. Maree has many years of experience in accounting and administrative roles, and has worked with a number of different accounting and payroll packages. Being a part timer benefits CSI too as this flexibility gives Maree time to work for other organisations, and she brings her experience of different working practices and knowledge back to CSI.

Pablo Mitchell
Wellington site technician and report writer

Pablo is a qualified Industrial Mechanic.Pablo has always been fascinated by technology and after working for a number of different companies joined a civil engineering company in Munich, where he has worked for the passed seven years. Initially, the role involved taking care of the machines and equipment, within a short time he was introduced by the company engineers to concrete NDT. He was immediately fascinated by the technology and quickly learnt the basics and is still learning.

Rayssa de Almeida
Auckland – Projects (part-time)

Rayssa has a background in Communications and Social-Media. Rayssa has lived in New Zealand for the last 7 years and worked across a variety of industries involving people management and national news reporting.

Daniel Traeger

Site technician, R & D and Wgtn Leader, report writer.

Previously 3D printing specialist; worked for Rocket Lab

Daniel spent 4 years at the University of Applied Science for Plastic Engineering. The following decade Daniel helped developing a technology called Selective Laser Sintering which is referred to under the umbrella term of 3D Printing.

Daniel was part of a small development team for material and process development. The following years Daniel swapped to work in the service field. As Operations Manager he served in and educated the NZ industry with the appropriate production strategies and technologies for their needs. After 16 years in this field he was excited to find CSI, a company utilising new and exciting technologies, trying to make a difference to make living in NZ safer. Daniel's experience in R&D but also in running operations and customer relations is helpful for CSI

Anujith Sukumaran

Site-Technician/Analyst

Anujith specialised in mechanical engineering and has now turned his hand to Non-destructive testing of concrete and steel.

Mark Hearfield
Assistant site-technician
Ex BRANZ Research

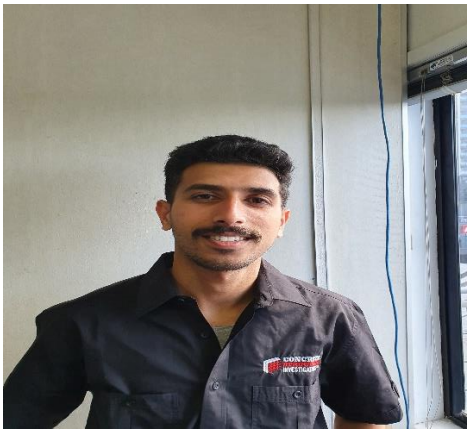
Mark works 'on call' to CSI when demand is high and extra hands are required. Mark has a formidable research and practical background. While qualifying as BSc in Physiology, he worked as a Science Technician at DSIR Ecology Division/Landcare for 14 years. Mark was a Senior Technician at BRANZ for 19 years and more recently divides his time between CSI and Passive Fire Protection.

Geoff Hulls, QS
Experienced QS in the Construction/Property Industry

Geoff Hulls is an experienced professional quantity surveyor and project manager and is an Associate of NZQIS. Geoff has been working in the construction industry for over 25 years and has been involved projects ranging from $100K to $120 million covering roles such as estimating, development management, project management and professional quantity surveying. Geoff brings a wealth of experience to CSI and while Geoff's role is primarily an estimator he is also a mentor providing support, oversight, training and assistance with business development (construction), systems, quality management, pricing, project management, contracts and project financial control. Geoff is also versatile and willingly provides help with day to day business operations primarily focusing on client project related matters.

Farhaad Ali
Auckland technician/Analyst

Farhaad is a qualified Civil Engineer, prior to joining CSI keen to he was a project engineer for commercial buildings. Farhaad has previously worked for 7 years in the Construction industry and his skills include technical Skills in construction, general site works, SIKA application and AutoCAD draughting.



Jaiz Joy
Auckland site tehnician/analyst

Jaiz is a qualified Mechanical Engineer, he is excited to join CSI and learn new skills and develop his knowledge and work experience.

17. AdvisoryBoard

Tim Howe. Ocean Partners

Ocean Partners' has a proven track record of working with clients to refine their transaction plans to ensure that they meet strategic company objectives and will deliver desired value.

Ocean Partners also provide some families with governance, administrative and comprehensive reporting services.

Governance and Ownership

Michael Roach-Gray and Jane Roach-Gray each currently oversee CSI 50/50. They are CSI Directors.

The Advisory Board is included in overview discussions and members of the Advisory Board may become Directors.

Services

QA and Scanning: **Quality assurance is necessary for successful building outcomes. Quality assurance of all work should occur at all stages throughout the building process, from project inception to final commissioning and handover.**

What is Scanning? Scanning is a non-destructive testing method used by CSI primarily to determine the details of steel reinforcement within concrete structures. CSI use two scanners:

1. Ground Penetrating Radar (GPR): The GPR scanner emits electromagnetic waves into a structure's subsurface. Changes in the material's properties, e.g. a change from concrete to steel, cause the waves to reflect. The signals produced by reflected waves allow us to determine details within the structure, such as centre spacing, cover, orientation and general layout of the reinforcement.

2. Ferroscan: The Ferroscanner emits a magnetic field into the subsurface. Asymmetric changes in the field allow us to identify the cover and diameter of reinforcement.

3. Bridge and deck scanning using GSSI scanning gear.

When would you use Scanning?

Scanning can be used to determine the size and layout of steel reinforcement within concrete elements, e.g. beams, columns etc., to help determine their structural capacity – so decisions can be made without invasive investigation.

What are the Benefits of Scanning?

- As mentioned above, scanning is non-destructive
- The scanners are portable, so testing can be carried out in remote areas
- GPR and Ferroscan are complementary – both technologies can be used in conjunction for even better results

Structural Health Monitoring

Wind, traffic, movement of people, changes in temperature or changes to a building itself can cause almost imperceptible stretches in concrete. Strain gauges can pick up changes at the microstrain level – in the order of 0.0001% change in length. This can be used in monitoring building loads over seconds or years. If a building has cracks, special crack monitors can be used to track whether they are growing, and how they fluctuate each day. Existing stresses can also be estimated within certain structures. This is particularly useful for old pre-stressed elements where the load on the strands is unknown.

Material Testing

CSI offers concrete and steel reinforcing bar properties testing through compressive and uniaxial tension tests, respectively. The test to determine compressive strength of concrete is conducted according to NZS 3112: Part 2: 1986 while the test to determine tensile strength of reinforcing bars is conducted according to AS/NZS 4671. Additionally, CSI is also able to determine weld shear strength of mesh reinforcement, where the test is conducted according to BS EN ISO 15630-2.

Rebar Corrosion Determination

Corrosion of reinforcing steel is an electrochemical process, and the behaviour of the steel can be characterised by measuring its half-cell potential. The greater the potential, the higher the risk that corrosion is taking place. An electrode forms one-half of the cell and the reinforcing steel in the concrete the other. CSI test to ASTM standard C876-09: Standard Test Method for Corrosion Potentials of Uncoated Reinforcing Steel in Concrete.

Pile Integrity Test

16.

Low strain integrity test is one of the methods for assessing the condition of cast-in-place piles, drilled shafts or driven concrete/timber piles.

The test is based on wave propagation theory. 'Low strain dynamic test' stems from the fact that applying a light impact to a pile produces a low strain.

This procedure is performed with a hand-held hammer to generate an impact, an accelerometer or geophone placed on top of the pile to measure the response to the hammer impact, and data acquisition, along with subsequent interpretation of the electronic equipment. PIT is standardised by ASTM D5882 Standard Test Method for Low Strain

Crack Monitoring

CSI use crack monitors to gauge horizontal or vertical movement across a crack on flat or adjacent surfaces.

Corrosion Condition Survey

Corrosion Condition Survey: CSI assesses the deterioration mechanisms and causes of the associated damage that are designed to lead to the selection of the appropriate corrosion mitigation technique(s).

CSI testing utilises:

Visual Inspection

Acoustic Sounding

Concrete Cover

Corrosion Potential

Chloride Content Test

Carbonation of Concrete

Rebar Corrosion Determination

Corrosion Control

Galvanic corrosion control is applied to areas between patch repaired sites, where corrosion has been initiated, but spalling has not yet occurred. Another sacrificial anode system is available to provide 'Galvanic corrosion control' to specific areas.

These anodes are inserted and grouted into predrilled holes, and electrically wired together in a grid pattern. ASTM Standard STP 1137: Corrosion Forms and Control For Infrastructure.

Pull-off/Shear Tests

ANCHOR TESTING: There are two types of tests depending on the goal: ultimate and proof test. An Ultimate test is carried out until failure of the connection is reached, either by reaching plastic deformation or complete breakage. Ultimate strength/deformation relationship can then be used in design calculations. On the other hand, proof testing is conducted when you want to make sure that an anchor has been correctly installed and not damaged; in this test the anchor is loaded up to a specific fraction of the rated load (not to failure).

PULL-OFF STRENGTH TEST: The Pull Off Strength Test can be used to evaluate the pull-off strength of Fibre Reinforced Polymer (FRP) laminate systems adhesively bonded to a flat concrete surface. The test determines the ultimate tensile strength an FRP system can sustain before detachment occurs. The test can be used for quality control and assessment of field repairs of structures using adhesive composite materials, such as FRP-wrapped concrete. The test is conducted following ASTM D7522

URM Testing

Unreinforced masonry.

Unreinforced Masonry or (URM) is a type of construction that has in the past been widely used in New Zealand, It can comprise of brick/stone or concrete blocks that are unreinforced and only bonded with a mortar or ties. URM structures pose a very real risk to failure and collapse in a significant earthquake, causing major repercussions.

While there are many ways and methods to secure and work with URM in existing structures it is paramount that the existing components condition and properties are tested so that an effective design can be applied.

URM Services:

- Concrete and URM scanning,
  - Identifying ties and spacings in existing URM structures.
  - Identifying cavities and thickness of existing URM structures.
  - Identifying mortar compaction.
  - Scanning nearby RC prior to use as structural connection.
- In situ measurement of masonry mortar joint shear strength
- URM compression testing.
- Anchor testing.
- Camera and drone survey.
- Scratch testing.

Ultrasonic Testing

Ultrasonic Testing is for a few applications the only technology providing answers while it is in general complementing our tool kit.
The technology is based on the principle of acoustic wave propagation by transducer emitted soundwaves reflected from objects of different density. The return signals enable a specialized analyst to make conclusions about the quantity and quality of the objects and structures. It is possible to perform localized testing as well as area analysis.
Ultrasonic testing is not only but in particular; useful for:

- Delamination, voids, leaks of filling and other defects
- Thickness and thickness variation, e.g. for slabs or tunnel linings up to 1000mm
- Objects and inclusions
- Grouting defects in Drossbachs and tendon ducts

CSI were hired on this job as sub-contractors for Gibbons Contractors. The bridge was experiencing a fair amount of corrosion due to it being in an estuary. Corrosion Control was used to protect the existing reinforcement.