

2021 RfP Guidelines

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Te Hiranga Rū QuakeCoRE: Centre for Earthquake Resilience

Issued 15 September 2021

Proposals Due Noon (NZT) Friday 15 October 2021

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1. Key Information: 2021 RfP Guidelines

Below is the key information about the 2021 QuakeCoRE Request for Proposals (RfP):

- Request for Proposals (RfP) Summary
 - Project proposals are invited in three key areas:
 - A: Disciplinary Theme (DT) & Inter-Disciplinary Programme (IP) Research Projects
 - B: Proposal Development Grants
 - C: Vision Mātauranga Focused Projects
 - D: Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) Focused Projects
 - Project funding will be for up to two years - and will cover the period from 1 April 2022 – 31 March 2024.
- A: Disciplinary Theme (DT) & Inter-disciplinary Programme (IP) Research Projects:
 - Disciplinary Theme (DT) & Inter-disciplinary Programme (IP) Research Programmes are comprised of non-contestable Coordinated Projects and contestable Research Projects funded under this RfP.
 - The Programme Area Leaders (PALs) have submitted a non-contestable Coordinated Project for review and endorsement. We encourage investigators to engage with the Programme Area Leaders to understand the opportunities to contribute to or align with this critical component of the overall Research Programme.
 - Contestable Research Projects (funded under this RfP) will complement the Coordinated Projects while still meeting the objectives of the Research Programmes described in Section 7 of the 2021 RfP Guidelines below.
 - Contestable Research Projects (funded under this RfP) can include support for research assistants, masters and PhD students. Funding for outstanding PhD students is also available specifically through the three-year PhD scholarship round. Details on the Scholarship application process are available [here](#).
- B: Proposal Development Grants
 - Applications from early-career researchers toward research-related costs for the development of contestable external research proposals targeting specific contestable funding programmes.
- C: Vision Mātauranga Focused Projects:
 - QuakeCoRE is actively seeking to increase our focus on Vision Mātauranga and Mātauranga Māori in the CoRE. This funding aims to support and develop projects with a strong Vision Mātauranga component that can contribute to the QuakeCoRE Vision Mātauranga strategy and research programme delivery.
- D: Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) Focused Projects:
 - Funding is available for projects that align with the CoRE's activities in the non-research programme areas of Communication, Education & Engagement (CEE) and Diversity, Equity,

Wellbeing & Inclusion (DEWI). Such projects may be research or non-research initiatives in support of CEE and DEWI goals and principles.

- Travel:

No applications for stand-alone travel grants to attend the QuakeCoRE Annual Meeting will be accepted as part of the RfP in 2021. Instead Annual Meeting travel grant applications will be aligned to the registration for the Annual Meeting each year. Annual Meeting travel should be included in all project applications.

- Workshops:

No expressions of interest for workshops aligned with the Annual Meeting are being sought via the RfP. In general, funding for workshops aligned with the QuakeCoRE Research Programme should be included as part of QuakeCoRE research projects.

2. Introduction

Te Hiranga Rū QuakeCoRE supports and co-ordinates research in earthquake resilience, providing a focal point for national and international collaborations. QuakeCoRE is a Centre of Research Excellence (CoRE) funded by the Tertiary Education Commission (TEC) from 1 July 2021 – 31 December 2028.

QuakeCoRE's mission is to place Aotearoa New Zealand at the worldwide forefront of earthquake disaster resilience by utilising Aotearoa New Zealand as a natural earthquake laboratory, producing new knowledge on the seismic response of the built environment, developing models to understand vulnerabilities within this environment, and designing innovative technologies and decision-support tools enabling rapid recovery of Aotearoa New Zealand communities.

QuakeCoRE's vision is an earthquake-resilient Aotearoa New Zealand where thriving communities have the capacity to recover rapidly after major earthquakes through mitigation and pre-disaster preparation informed by internationally-leading research excellence.

Building on achievements during 2016-2020 (Phase 1), the second phase of Te Hiranga Rū QuakeCoRE will establish multi-institutional research programmes with international networks. The research programmes (Figure 1) will advance the science and implementation pathways of earthquake resilience through system-level science with deep collaborations coordinated across engineering, physical and social science disciplines and research institutions. The primary research structure is two-tiered in nature with: (i) Disciplinary

Themes; and (ii) Inter-disciplinary Programmes, the latter representing the convergence of several themes toward the vision of earthquake resilience.

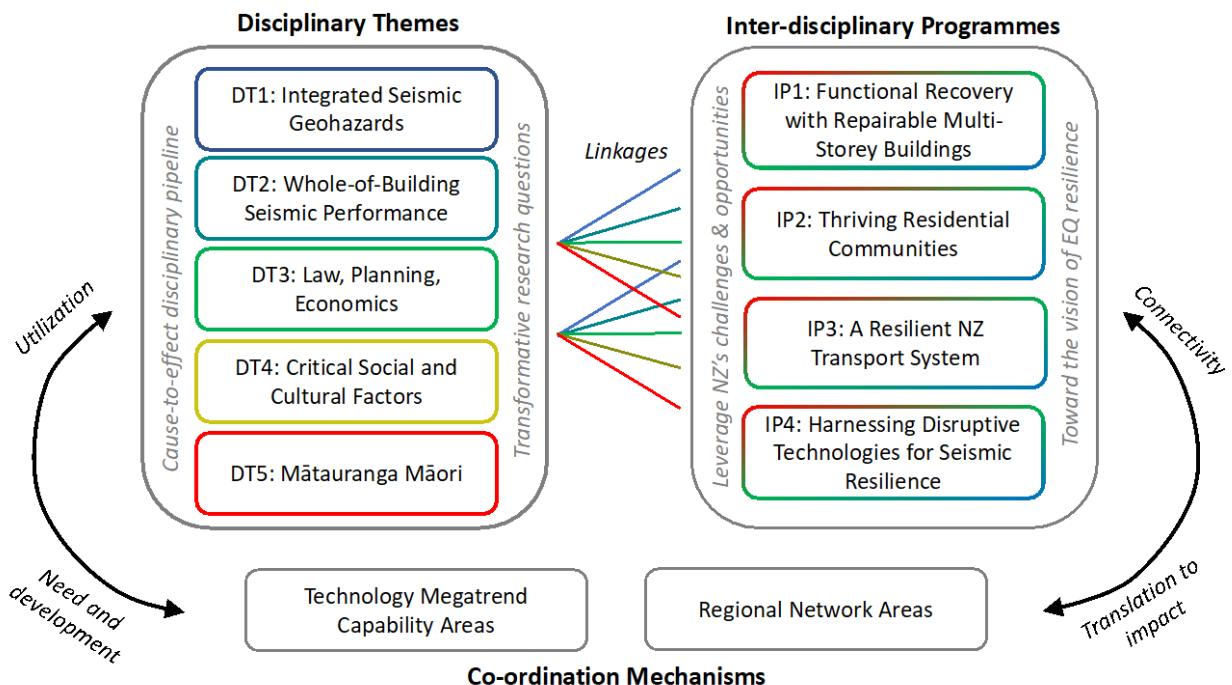


Figure 1: Te Hiranga Rū QuakeCoRE (Phase 2) Research Structure. Disciplinary Themes collectively span the disciplinary pipeline of earthquake resilience research and focus on transformative research questions; Inter-disciplinary Programmes leverage Aotearoa New Zealand's unique challenges and opportunities toward the global vision of earthquake resilience using Aotearoa New Zealand as a natural earthquake laboratory; Coordination Mechanisms enhance the Disciplinary Themes and Inter-disciplinary Programmes through accelerating capability development and utilization of research technologies, and regional networks that provide connectivity and a pathway to impact.

Key Initiatives

Disciplinary Themes: Research areas that collectively span the disciplinary pipeline of earthquake resilience and focus on transformative research questions in which *Aotearoa New Zealand* researchers have shown global leadership.

Inter-disciplinary Programmes: Inter-disciplinary research that leverages *Aotearoa New Zealand's* unique situation and challenges to advance the vision of earthquake resilience. These programmes draw on expertise in multiple disciplinary themes.

Communication, Education and Engagement (CEE): QuakeCoRE's guiding principle for work in this space is "sharing our research to build collective understanding of earthquake resilience that enables diverse communities to take action". QuakeCoRE researchers who wish to participate in Communication, Education and Engagement activities are encouraged to contact our Associate Director – Communication, Education & Engagement at any time with ideas for collaboration.

Diversity, Equity, Wellbeing & Inclusion (DEWI): DEWI enables equitable and inclusive education and research which transforms earthquake resilience in our diverse local and global communities. DEWI

principles are essential to research excellence and underpin the Vision, Mission and Core Values of Te Hiranga Rū QuakeCoRE, as a basis to support and encourage the open exchange of ideas, expression and debate that is inclusive of gender, age, ethnicity, religion and other identities. Te Hiranga Rū QuakeCoRE supports a research community that recognises the inherent worth of every person and group (both within and external to Te Hiranga Rū QuakeCoRE), through actions that foster dignity, understanding and mutual respect.

2021 RfP Guidelines: This document, referred to as the *2021 RfP Guidelines*, describes the mechanisms for collaboration and solicits proposals from investigators to participate in the QuakeCoRE programme.

3. Proposal timelines

The timelines for all project proposals submitted under this RfP are:

- 15 September 2021: Request for Proposals (RfP) released
- Friday 15 October Noon NZT: Applications close. Late proposals will not be accepted
- November: Evaluation and review process
- Mid-December: Outcomes advised
- 1 April 2022: Projects commence

4. Guidelines for proposal submission

Submission Instructions: Proposals must be submitted via email to: quakecore@canterbury.ac.nz.

Formatting Instructions: All proposals must use the QuakeCoRE RfP Application Form Template available on the QuakeCoRE website [here](#).

Investigator responsibilities: To achieve the QuakeCoRE mission, QuakeCoRE investigators are expected to interact with the QuakeCoRE community on a regular basis (eg attending the Annual Meeting and presenting QuakeCoRE-funded research in the poster sessions, attending monthly Research Programme meetings and the QuakeCoRE Seminar Series), and to contribute all relevant data, experimental and analysis results and computational codes/models to the appropriate open-source repositories. Publications resulting entirely or partially from QuakeCoRE funding must include a QuakeCoRE publication number and funding acknowledgement. By submitting a proposal, investigators are agreeing to these conditions, and performance in this regard will be considered in future QuakeCoRE proposals.

Eligibility: Specific eligibility is as follows:

- A: Disciplinary Theme (DT) and Inter-disciplinary Programme (IP) Research Projects
 - Limit of one application per investigator as the project lead and listed as a researcher on a maximum of two projects at any point in time, including the application stage.

- Proposals will primarily be submitted by QuakeCoRE Associate Investigators (AIs) or Principal Investigators (PIs), consideration will also be given to researchers who are newly engaged with the 2021 – 2028 Te Hiranga Rū QuakeCoRE Research Programme.
- Programme Area Leaders are eligible to apply but clear and compelling reasons must be given as to why the proposed project is not being supported via Coordinated Project funding or other QuakeCoRE funding. .

- B: Proposal Development Grants
 - Limit of one application per investigator as the project lead and listed as a researcher on a maximum of two projects at any point in time.
 - Proposals will primarily be submitted by QuakeCoRE Associate Investigators (AIs) consideration will be given to researchers who are newly engaged with the 2021 – 2028 Te Hiranga Rū QuakeCoRE Research Programme.
 - Applications in this category will only be accepted from early-career researchers, for the purposes of this RfP, these are considered to be researchers that completed their PhD no more than 7 years ago, as at 30 September, 2021, extensions to this timeframe will be considered for parental leave or similar career breaks.

- C: Vision Mātauranga Focused Projects
 - Limit of one application per investigator as the project lead and listed as a researcher on a maximum of two projects at any point in time.
 - Proposals will primarily be submitted by QuakeCoRE Associate Investigators (AIs) or Principal Investigators (PIs), consideration will be given to researchers who are newly engaged with the 2021 – 2028 Te Hiranga Rū QuakeCoRE Research Programme.
 - Programme Area Leaders are eligible to apply but clear and compelling reasons must be given as to why the proposed project is not being supported via the Coordinated Research Programme or other QuakeCoRE funding

- D: Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) Focused Projects:
 - Limit of one application per investigator as the project lead and listed as a researcher on a maximum of two projects at any point in time.
 - Proposals will primarily be submitted by QuakeCoRE Associate Investigators (AIs) or Principal Investigators (PIs), consideration will be given to researchers who are newly engaged with the 2021 – 2028 Te Hiranga Rū QuakeCoRE Research Programme.
 - QuakeCoRE researchers that wish to apply for funding under the Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) focused project category are strongly encouraged to discuss their proposed project with the Associate Director - CEE or Interim Associate Director – DEWI, as appropriate.

Budget guidance: Disciplinary Theme (DT), Inter-disciplinary Programme (IP) Research Project proposals, Vision Mātauranga Focused Projects and Non-Research Programme Area Projects funded under this RfP

should be of a reasonable scale; between \$20,000 and \$70,000. Proposal Development Grants should be for total project budgets of less than \$15,000.

Note that budgets cannot include investigator salary or CapEx. Postgraduate student stipends should be at the following annual rates:

- 1) \$15,000 for a fulltime Masters stipend with compulsory domestic tuition fees or
- 2) \$27,500 for a fulltime PhD student stipend with a contribution of \$8,000 for fees.

QuakeCoRE Annual Meeting Travel funding of up to \$1,000 per year should be included in the budget for all key research contributors that do not already have funding from another QuakeCoRE source.

Award procedures: QuakeCoRE is funded by the TEC as a Centre of Research Excellence (CORE). All dispersed funding will be in the form of a standardized subcontract from the University of Canterbury as Host institution, and subject to the conditions of the funder, TEC.

Review and Evaluation: Review coordination and evaluation of proposals is performed by the RfP Review Panel (comprising the QuakeCoRE Research Planning Committee and industry representatives for each Programme area, or delegates as well as members of the DEWI and CEE Committees), and proposals will be either funded or rejected, without negotiation with the project leader.

5. Evaluation process and criteria

Proposals submitted should respond directly to the 2021 RfP Guidelines. A primary consideration in evaluating proposals will be how directly the proposal addresses the mission and vision of QuakeCoRE.

Proposals will be evaluated against basic eligibility criteria:

Budget: Budget is in line with funding guidelines and includes only eligible expenditure

Eligibility: Project is led by an eligible member of the QuakeCoRE community

Vision Mātauranga: Project demonstrates an appropriate consideration and incorporation of Vision Mātauranga

Fit: Project is within programme scope

Projects that meet the basic eligibility criteria listed above will be sent to the review panel for assessment. The specific evaluation criteria for Categories A, B and C used by the panel and their weighting are:

Research Excellence (40%)

- Quality of proposed research
- Track record and ability to deliver proposed research

Human Capability Development (30%)

- Involvement of students and emerging researchers
- Development and support for all, including but not limited to, Māori as tangata whenua and / Pasifika people, engineers who identify as women, and those who identify as gender diverse.

Fit with QuakeCoRE Mission and Values (30%)

- Priority of the proposed research for the QuakeCoRE Research Programme

- Commitment of investigators to the QuakeCoRE mission and values, including strong collaboration
- Value of research relative to its cost
- Relevance and translation to practice including direct and active involvement of end-users and stakeholders

For projects submitted under Category D: Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) Focused Projects, the weighting of the evaluation criteria shall be:

- Research Excellence - 20%
- Human Capability Development – 40%
- Fit with QuakeCoRE Mission and Values – 40%

Vision Mātauranga

The consideration of Vision Mātauranga will follow that of Royal Society of New Zealand Te Apārangī.

Proposals are requested that are developed to reflect Māori research needs, interests, objectives and priorities concerning Māori and national built, social, economic and environmental resilience to earthquakes. Applicants may find further guidance and information at the following links:

- MBIE Vision Mātauranga Policy ([Link](#))
- MBIE Vision Mātauranga Booklet ([Link](#))
- Royal Society Vision Mātauranga Guidelines ([Link](#))

This Vision Mātauranga policy is about innovation, opportunity and the creation of knowledge that highlights the potential contribution of Māori knowledge, resources and people.

There are four themes:

- Indigenous Innovation, which involves contributing to economic growth through *distinctive research and development*;
- Taiao, which is concerned with achieving *environmental sustainability* through iwi and hapū relationships with land and sea;
- Hauora/Oranga, which centres around improving *health and social wellbeing*; and
- Mātauranga, which involves exploring *indigenous knowledge*.

Vision Mātauranga is now included as an assessment criterion for all QuakeCoRE projects.

Proposals should consider the relation of the research to the themes of Vision Mātauranga and, *where relevant*, how the project will engage with Māori.

Where research projects are of relevance to Māori or involve Māori, QuakeCoRE expects that applicants are in consultation with Māori at the planning stage, so as to achieve the best possible outcomes.

Up to one additional page will be available for statements on Vision Mātauranga. This is to enable Vision Mātauranga to be more easily integrated into the conceptual framework and/or research design. Where Vision Mātauranga is appropriate to a proposal, it can contribute to the assessment of its overall excellence.

How do I decide whether to include a Vision Mātauranga statement in my proposal?

A Vision Mātauranga statement must be included for all research that has relevance for Māori. The research category descriptions outlined in the next section may help you decide if this applies to your project. Please

note, however, that those categories are fluid, there may well be overlap between them, and not every point in each category need apply.

Categories of Research

The five categories identified below have been adapted from those on the National Science Challenge, Biological Heritage website hosted by Manaaki Whenua Landcare Research ([Link](#)). Please note that there may well be overlap between categories as in categories 2 and 3 in terms of the nature and degree of relevance to Māori.

The original categories were set out by MBIE in information for the Endeavour Fund c. 2015. Further details on each category and further guidance on developing a Vision Mātauranga statement are available [here](#):

1. Research with no specific Māori component
2. Research involving Māori
3. Research specifically relevant to Māori
4. Māori-centred research
5. Kaupapa Māori research

Key Criteria for 2021 RfP

Proposals will be assessed on the RfP selection criteria, however we have identified areas where priority will be given to proposals that appropriately support our focus on the following areas:

- A: Disciplinary Theme (DT) and Inter-disciplinary Programme (IP) Research Projects
 - Support projects aimed at securing future external funding.
 - Support research activities that leverage existing research projects
 - Support Associate Investigators and project leaders that identify as Māori or Pasifika; Associate Investigators in engineering disciplines that identify as women, early-career researchers', those returning from industry, and those who identify as gender diverse. Include students that identify as Māori or Pasifika, or female students in engineering disciplines.
- B: Proposal Development Grants
 - Support Associate Investigators and project leaders that identify as Māori or Pasifika; Associate Investigators in engineering disciplines that identify as women, early-career researchers', those returning from industry, and those who identify as gender diverse.
- C: Vision Mātauranga Focused Projects
 - Support the implementation of our Vision Mātauranga Strategy.
 - Support Investigators and students that identify as Māori.
 - Support projects aimed at securing future external funding.
 - Support Associate Investigators and project leaders that identify as Māori or Pasifika; Associate Investigators in engineering disciplines that identify as women, early-career researchers', those returning from industry, and those who identify as gender diverse.
- D: Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) Focused Projects:
 - Support projects aimed at securing future external funding.
 - Support Associate Investigators and project leaders that identify as Māori or Pasifika; Associate Investigators in engineering disciplines that identify as women, early-career researchers', those returning from industry, and those who identify as gender diverse.

The RfP Review Panel includes representation from the Research Programme Area, end-users and stakeholders.

All proposals will be reviewed by multiple RfP Review Panel members, avoiding any conflicts of interest. The RfP Review Panel members will be assigned proposals to independently review against the evaluation criteria above. A conflicts register will be kept to ensure that the review process has transparent conflict management. An independent observer will be present during the review meeting to provide an impartial view and ensuring that fair review processes are followed for all proposals.

The RfP Review Panel is responsible for recommending a balanced research programme and budget to the QuakeCoRE Director, which will be combined into an annual spending plan for submission to the QuakeCoRE Board.

The review process is planned to be completed and applicants notified by mid-December 2021 for project funding which will commence on 1 April 2022.

6. Co-ordination with other research support

Earthquake resilience research in Aotearoa New Zealand is supported by both QuakeCoRE and numerous other funding agencies, including the: NZ Earthquake Commission (EQC), Resilience to Natures Challenges National Science Challenge (RNC-NSC), MBIE, Callaghan Innovation, NZ Transportation Agency, Building Research Association NZ (BRANZ), Natural Infrastructure Unit (NIU), among others. Earthquake resilience-related research in Aotearoa New Zealand has also been actively supported by numerous 'general' NZ funding agencies (e.g., Marsden Fund, Rutherford Discovery Fellowships, MBIE Contestable Round), international partnership funding (e.g., US NSF, JSPS, EU Framework Programme), and direct industry funding by numerous private companies.

It can be seen from the numerous and diverse range of funders above, that the annual funding provided by QuakeCoRE represents a small portion of the overall annual Aotearoa New Zealand spending on earthquake resilience R&D. QuakeCoRE will also focus on providing enabling funding which will, among other things: (i) establish and foster collaborative research across institutions and disciplinary boundaries; and (ii) establish new research directions, enhance existing research funded by other agencies through strategic directed funding, and deliver tangible end-user outcomes.

In the context of those comments above, investigators should ensure that submitted proposals 'fit' the QuakeCoRE vision, mission and evaluation criteria, and that their proposal identifies aligned funding from other funding agencies in Aotearoa New Zealand. Investigators should also ensure the proposal is not better suited to one of the other Earthquake Resilience R&D funders noted above. Additional support and guidance on the research funding landscape and bid-writing process is available to early career Te Hiranga Rū QuakeCoRE researchers through the Research Identification Committee.

7. Research Programmes

The QuakeCoRE research programme structure is comprised of Disciplinary Themes (DTs) and Inter-disciplinary Programmes (IPs), as described in earlier sections. The sections below outline the priorities and requirements pertaining to the research programme, which investigators should utilize in developing proposals in response to this 2021 RfP. The information below is taken from the Te Hiranga Rū QuakeCoRE Three-year Plan 2021 – 2024. It is recommended that proposal Project Leaders review the summaries below to identify how their proposal aligns with, and contributes to, this programme of work to support the QuakeCoRE mission. Additional information and guidance on how research project proposals can be aligned with current activities within the Research Programmes is available from the relevant Programme Area Leader(s) and applicants are encouraged to get in touch to discuss this prior to submission.

Disciplinary Theme 1: Seismic demands and consequent Geohazards

This Disciplinary Theme focuses on the principal research question - what are the salient physics and mechanics that govern seismic geohazards and how can we advance prediction accuracy and precision through integrated observational, empirical and physics-based datasets, methods, and associated tools? These geohazards span the traditional disciplines of engineering seismology, geotechnical engineering, and engineering geology, which this disciplinary theme will synthesise to enable significant advances in understanding and predictive modelling. Furthermore, utilising modern tools and methods also provide new avenues, in particular: (i) monitoring and sensing (both explicit and remote sensing); (ii) application of machine learning methods to data-rich problems to infer salient physics that is currently poorly understood; and (iii) physics-based models that attempt to honour governing mechanics. Targeted laboratory and field experiments will be undertaken toward achieving the overall aims within this theme.

Objectives	Deliverables
1.1 Ground-motion modelling	Advance the validation of ground-motion simulation methods and perform simulation-based hazard analysis for all of NZ as an illustration of future hazard analysis
1.2 Liquefaction impacts	Improve the characterization of NZ-specific soils, develop and implement advanced numerical models for soil behaviour using effective stress analysis for practical applications
1.3 Fault rupture and co-seismic landsliding	Development and application of empirical and simulation-based models of surface fault rupture displacement to major faults in NZ that impact urban areas and critical infrastructure
1.4 Geohazard integration	Develop and implement integrated computational tools for simulation of ground motion, liquefaction, landsliding and fault rupture hazards

Disciplinary Theme 2: Whole-of-building seismic performance

This Disciplinary Theme will address the following primary research questions: (i) How do component interactions ignored during conventional design affect the seismic response and damage that occurs to buildings? (ii) What are the demands imposed on acceleration- and displacement-sensitive non-structural components attributed to interaction with structural components? (iii) How does improved understanding of whole-of-building response affect the seismic performance and loss estimates over the life of a building? The mechanics of component interactions will be investigated using a combination of large-scale structural testing, data from international collaborative building tests, and field measurements from instrumented buildings. These data sources will be used to develop, calibrate and validate methods of modelling component interactions using state-of-art numerical simulations. Lastly, synthesis and translation of these models to design methods will result in immediate improvements in building performance in future earthquakes.

Objectives	Deliverables
2.1 Component interactions	Quantification of the effects in assessment and conventional design of non-seismic components of a structure that affect behaviour
2.2 Demands on acceleration- and drift-sensitive non-structural components	Quantification of the seismic demands that different non-structural components are subjected through numerical modelling calibrated with experimental testing.
2.3 Seismic performance and loss estimation	Performance and loss estimation studies to benchmark the seismic performance of different structures using conventional and emerging technologies.

Disciplinary Theme 3: Planning, law, and economics

This Disciplinary Theme provides a focal point for economists, planners, and legal scholars to deliver the key expertise required for the translation of science into policy that is necessary for the implementation of many of the innovations being developed across the QuakeCoRE community. Specifically, the theme will create an evidence-based approach to seismic resilience policy which links risk measures to the formulation and implementation of holistic policy frameworks across three distinct but linked research objectives: (i) Spatially-detailed modelling of economic damage from seismic hazards, and statistical assessment of previous earthquake impacts; (ii) Improved legal and planning frameworks to enable the mainstreaming of seismic resilience in NZ; and (iii) Design, and testing of specific resilience-building tools and processes, such as those developed in the second objective, and including behavioural ‘nudges’ to incentivise resilience.

Objectives	Deliverables
3.1 Econometric analysis of historical earthquake impacts	Adapt probabilistic methods for quantifying seismically-induced damage to individual infrastructure assets through the integration of seismic hazard, infrastructure response, and damage and loss with quantification considering of the impact on all the Four Capitals, and implicitly include broader definitions of wellbeing
3.2 Legal and planning frameworks	Mainstreaming of seismic hazard management through the development of ground-breaking holistic legal and planning frameworks
3.3 Resilience-building tools	Analyse incentives and policies in seismic risk reduction based on the quantifications obtained in objectives 3.1 and 3.2.

Disciplinary Theme 4: Cultural and social factors shaping resilience

This Disciplinary Theme comprises three objectives that will investigate human behaviour immediately prior to and during earthquake shaking; the linkages between risk interpretations and actions; and the role of national and regional hazard initiatives in NZ in the production of tools for resilience, including response plans and frameworks, and increased awareness through community outreach. Key research questions include (i) How do people respond to earthquake shaking and earthquake warnings? (ii) Do responses vary across different temporal, spatial, social and cultural contexts? (iii) How can we evaluate the efficacy and effectiveness of earthquake resilience-building programmes?

Objectives	Deliverables
4.1 Investigate human behaviour immediately prior to, during, and immediately after earthquake shaking to develop strategies to reduce earthquake deaths and injuries	Experiments to explore human responses to earthquakes through laboratory testing
4.2 Understand how human interpretations of, and responses to earthquake risk can shape the development of earthquake risk reduction strategies, including the temporal and spatial variation of understandings of earthquake risk across Aotearoa New Zealand	Co-design a community engagement strategy with councils and central government around seismic risk education in lower seismic hazard zones
4.3 Improved understanding of the effectiveness of earthquake communication, education and engagement activities through collaboration and evaluation	Develop a programme to enhance the use of the CEISMIC digital archives

Disciplinary Theme 5: Mātauranga Māori and earthquake resilience

This Disciplinary Theme will undertake community-led and co-designed participatory research to create and innovate Mātauranga Māori (Māori knowledge) that will facilitate achievement of the earthquake resilience aspirations of tangata whenua. Knowledge translation of research findings will encourage increased understanding within QuakeCoRE of iwi, hapū and whānau perspectives on earthquakes and disaster risk reduction. Innovative earthquake hazard management tools, including earthquake preparedness, response and recovery strategies, will also be created to enhance earthquake resilience.

Specific research objectives will be underpinned by a Te Ao Māori perspective, and driven by Māori research partners in order to ensure that the design and conduct of research projects remain culturally relevant and appropriate. Acknowledgement and respect for Māori research partners' tino rangatiratanga will likely highlight new foci for research. Kaupapa Māori research methodologies will shape the majority of

Mātauranga Māori research as such approaches are preferred by iwi, hapū and whānau. Thus, projects are also likely to be community-led and determined rather than community-based and researcher determined. The research discovery process will involve the following key steps: (i) Commencing the process of Whakawhānaungatanga (establishing connections and points of engagement); (ii) Documenting community resilience-related needs from a cultural perspective; (iii) Mapping Māori aspirations in relation to earthquake resilience; (iv) Identifying culturally appropriate mechanisms for up-skilling iwi/Māori community resilience research capability, including the development of rangatahi (youth), and a conduit for young Māori into tertiary education programmes; and (v) Eventually negotiating a selection of Kaupapa Māori community-led research projects that are relevant to QuakeCoRE and selecting appropriate research teams with input from iwi stakeholders to conduct the research.

Objectives	Deliverables
5.1 Whakawhānaungatanga	Establishing connections and points of engagement with iwi, hapū and whānau
5.2 Documentation	Documenting community resilience-related needs from a cultural perspective
5.3 Aspirations	Mapping Māori aspirations in relation to earthquake resilience
5.4 Capability development	Identifying culturally appropriate mechanisms for up-skilling iwi/Māori community resilience research capability, including the development of rangatahi (youth), and a conduit for young Māori into tertiary education programmes
5.5 Project selection and execution	Negotiating a selection of Kaupapa Māori community-led research projects

Inter-disciplinary Programme 1: Functional recovery with repairable buildings

This Inter-disciplinary Programme will provide the underlying science to support the development of the world's first functional recovery-based seismic design standard. It will build on understanding of whole-of-building seismic performance from DT2. Focusing on the functional recovery of multi-storey buildings, this Inter-disciplinary Programme will include three objectives, each seeking to answer research questions key to achieving functional recovery: (i) What *low-damage solutions* provide high confidence in maintaining functionality for even rare seismic demands? (ii) What is the expected performance of a damaged building in subsequent earthquakes (with or without repair) and what level of damage requires *repair*? (iii) What *timeframes for restoration* of function are achievable and acceptable considering external constraints and stakeholder requirements?

Objectives	Deliverables
6.1 Drivers for change	Documentation of the broad drivers for change in the seismic design of buildings and consideration of functional recovery
6.2 Maintaining functionality	Development of design factors and methods for creating building systems that maintain functionality through moderate to large earthquakes
6.3 Repaired buildings	Development and documentation of a means to address social and technical barriers to repair of earthquake-damaged buildings
6.4 Timeframes for restoration of function	Documentation summarising the complexities influencing functional recovery timeframes and quantification of those parameters that drive the step changes in functional recovery timeframes for multi-storey buildings

Inter-disciplinary Programme 2: Thriving residential communities

This Inter-disciplinary Programme will consider the following research questions toward achieving thriving residential communities following major earthquakes: (i) What are the structural and geotechnical engineering innovations that can lead to a drastic reduction in earthquake-induced physical damage to housing? (ii) How can land use planning and geotechnical engineering be synthesised to avoid the construction of new housing in highly vulnerable areas? (iii) How can lifeline infrastructure servicing residential areas be fortified in a cost-effective manner? (iv) What are the policies that can drive the development of new earthquake-resilient housing and communities; and incentives, or public awareness initiatives, for owner-funded retrofit of existing housing? (v) Is there a mismatch between owner/tenant expectations of housing earthquake resilience, and, if so, how do communities feel that addressing this should be financed? The research to answer these questions will lead to a broad range of improvements, including the development of innovative engineering, land-use, social and policy provisions. Through leveraging NZ's recent experiences, expertise, and access to essential datasets, our research will be applicable in both national and international settings.

Objectives	Deliverables
7.1 Traditional housing and foundations	Identify transformative changes to traditional housing and foundation systems that mitigate losses and disruption in future earthquakes
7.2 New construction solutions	Identify new single-dwelling and medium density housing construction solutions that offer the potential of accelerated construction speed and quality control
7.3 Cost-effective retrofit solutions	Develop cost-effective retrofit solutions for existing buildings. This research will draw on developments made for commercial buildings, including value-propositions for new technologies in the construction sector

Inter-disciplinary Programme 3: A resilient New Zealand transport system

A multi-modal system approach is critical to understand how transport modes interact and to explore options to improve the resilience of transport networks and the energy networks that support their functionality, now and into the future. This programme seeks to integrate our understanding of components, networks and users of the transport system to evaluate pre-event resilience investments and develop post-event adaptations and recovery strategies that can support the range of future growth and consolidation pathways. This requires an understanding of the wider networks and their users, the interfaces between transport modes, the energy sources that support each transport system, and how our resilience to disruption may change as our communities, technology, economy and environment change over time. Research will seek to answer the following central questions: (i) How can a transport-as-a-service modelling paradigm allow efficient decision making under deep uncertainty? (ii) What is the interaction of strategic transport hubs in the system-level resilience of transportation networks? (iii) How can resilient transportation networks and logistics play an enhanced role in post-disaster response and recovery? Research will be framed around multiple earthquake scenarios that result in severe regional and broader national transport disruption.

Objectives	Deliverables
8.1 Transport-as-a-service	Quantify the effects of the emerging transportation-as-a-service paradigm as a means to allow efficient decision making under deep uncertainty
8.2 Network interactions	Develop network models to quantify the interaction of strategic transport hubs in the system-level resilience of transportation networks, and apply to case studies

8.3 Logistics post-event response and recovery	Using NZ as a case study, explore the balance of efficiencies and resilience of these hubs, including beyond just internal economic drivers
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Inter-disciplinary Programme 4: Harnessing disruptive technologies for seismic resilience

This Inter-disciplinary Programme focuses on three exemplary objectives of disruptive infrastructure technologies (*renewable distributed energy, smart cities, electric autonomous transportation*) under a range of plausible forward-looking scenarios to 2030, 2040 and 2050. We will investigate how these technologies may be harnessed to maximise not only economic objectives, but also to create seismic resilience co-benefits while minimising societal and environmental costs associated with increased inter-connectedness, ‘lock-in’ path dependencies and inequitable distributional impacts. Through these case studies we will develop novel integrated dynamic models, which sit at the convergence of data and system science, widening the investment evaluation lens to capture economic and wellbeing indicators through time for multiple stakeholders.

Objectives	Deliverables
9.1 Renewable distributed energy	2050 scenarios for the landscape of earthquake resilience based on the rapid changes in decentralized electricity generation, transmission and distribution
9.2 Smart cities	How can real-time sensing enable early detection of network degradation pre-event, and situational awareness in the immediate post-event environment for rapid restoration
9.3 Electric autonomous transport	Quantification of the trade-off in electrification of transportation, reducing vulnerable reliance on liquid fuels, but increasing resilience requirements for electricity, play out over time; and how autonomous transportation modes function in a non-business-as-usual environment

Application Form

The QuakeCoRE 2021 RfP Guidelines are available on the [QuakeCoRE website](#)

2021 QUAKECoRE REQUEST FOR PROPOSALS (RfP) APPLICATION FORM

INSTRUCTIONS [DELETE THESE INSTRUCTIONS BEFORE SUBMISSION]

- All text in this proposal must be Calibri 11pt.
- CVs must be provided for each investigator. Please append CVs in Standard MBIE format (5 pages). CV template is available on the QuakeCoRE [webpage](#).
- Applications must be submitted with three files – a single Word file consisting of this form and a second PDF containing the CV(s). The budget should also be attached as an Excel spreadsheet using the template available on the QuakeCoRE website. Files should be named in the following format:
 - QC_RfP_2021_"Project Leader Surname"_"Project Code"_"Document Type"
 - Project Code:
 - A: Disciplinary Theme (DT) & Inter-Disciplinary Programme (IP) Research Projects
 - B: Proposal Development Grants
 - C: Vision Mātauranga Focused Projects
 - D: Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) Focused Projects:
 - For example QC_RfP_2021_Smith_A_Application or QC_RfP_2021_Smith_A_CV or QC_RfP_2021_Smith_A_Budget
- Proposal Development Grant Applications must be submitted on the dedicated application form, available on the Te Hiranga Rū QuakeCoRE [webpage](#).
- Proposal submission is only via email to quakecore@canterbury.ac.nz
- Additional information is available on our [webpage](#) whilst the RfP is open.

EVALUATION CRITERIA

The evaluation criteria are detailed in the RfP Guidelines, available [here](#).

Application Type: Choose an item.

Is the Project Leader an Early Career Researcher¹: Choose an item.

Project Leader's Surname:

Project code: QC_RfP_2021_[Project Leader Surname]_[Application Type Letter]

Title of proposed project:

Which specific parts of the research programme does this project cover?

[Information on the Research Programme Areas can be found [here](#)]

Primary Area

Choose an item.

¹ Early Career Researchers are researchers that completed their PhD no more than 7 years ago, as at 30 September 2021. Extensions to this timeframe would be considered for parental leave or similar.

Project Contributors

[Provide the names of the project Investigators (including industry representatives and partners) together with their affiliations.

In addition to identifying Project Leader and Investigator roles and responsibilities, (e.g. Project Leader, Project Investigator, Student, Industry partner), identify their contribution to the project and how the proposal is supporting (not necessarily financially) human capability development of early career researchers and students.

Early Career Researchers are researchers that completed their PhD no more than 7 years ago, as at 30 September 2021². Delete this text before submission]

Project Leader Name (Organisation)	Quake CoRE AI / PI	Quake CoRE Industry Affiliate						Project Role [Briefly describe the investigator's contribution to the project]
			Female Engineer	Māori	Pasifika	Gender Diverse	Early Career	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Name (Organisation)			<input type="checkbox"/>					
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

² Extensions to this timeframe would be considered for parental leave or similar.

Project Proposal

[Suggested maximum total length of project proposal is up to 10 pages.]

1. Project Abstract:

[Suggested Length: 200 words. Delete this text before submission]

2. Detailed outline of project:

[Outline the research context; its key objectives; the research methodology to address them; the impact that this project will have; and the roles and responsibilities of the project team (including the industry representative if appropriate).

This section should also address how the proposed research applies, adapts or complements any earlier work, its relevance and urgency of application and by what means it is intended to address a gap in present knowledge and practices; and potential follow on research beyond the project funding period; References cited should appear at the bottom of this section. RfP Disciplinary Theme (DT) & Inter-Disciplinary Programme (IP) Research Projects should indicate how this project proposal relates to the Coordinated Research Project in the relevant research area.

Use the subheadings below. Delete this text before submission]

Proposal Context:

[Use this section to give a background for the proposal. Delete this text before submission]

Proposal Objective:

[Use this section to state the specific objective of the research proposal. Delete this text before submission]

Proposed Research :

[This section should cover, where appropriate, the hypotheses being tested, the methodology to be used, sampling design, and methods of data analysis. Please ensure that your description covers the proposal duration, and that it includes contributions by collaborators and postgraduate students (if any).

If you identified fit with one or more Vision Mātauranga themes, please elaborate here how this fits in with your proposed research. For example, you may wish to discuss consultations and linkages, relevance, conceptual framework and/or proposal design, and outcomes (in addition to the required statements in Vision Mātauranga Section below). Delete this text before submission]

Vision Mātauranga:

The consideration of Vision Mātauranga will follow that of Royal Society of New Zealand Te Apārangi.

This Vision Mātauranga policy is about innovation, opportunity and the creation of knowledge that highlights the potential contribution of Māori knowledge, resources and people.

There are four themes:

- Indigenous Innovation, which involves contributing to economic growth through *distinctive research and development*;
- Taiao, which is concerned with achieving *environmental sustainability* through iwi and hapū relationships with land and sea;
- Hauora/Oranga, which centres around improving *health and social wellbeing*; and
- Mātauranga, which involves exploring *indigenous knowledge*.

Proposals should consider the relation of the research to the themes of Vision Mātauranga and, *where relevant*, how the project will engage with Māori.

Categories of Research

The five categories identified below have been adapted from those on the National Science Challenge, Biological Heritage website hosted by Manaaki Whenua Landcare Research ([Link](#)). Please note that there may well be overlap between categories as in categories 2 and 3 in terms of the nature and degree of relevance to Māori.

The original categories were set out by MBIE in information for the Endeavour Fund c. 2015. Further details on each category and further guidance on developing a Vision Mātauranga statement are available [here](#):

1. Research with no specific Māori component
2. Research involving Māori
3. Research specifically relevant to Māori
4. Māori-centredresearch
5. Kaupapa Māori research

Researchers should consult their institutional advisor to get assistance in determining the relevance of the proposed study for Māori. Delete this text before submission]

Which of the categories of research listed above best describes this project?

Choose an item.

Where you have identified relevance to Māori, please select which Vision Mātauranga theme the project best aligns with?

Choose an item.

For projects that haven't identified relevance:

[Provide a short statement on how this assessment was made and the process that was undertaken.
Delete this text before submission]

For projects which have identified relevance:

[Where you have identified relevance, please include up to 1 page discussion on consultation and linkages, relevance, fit with iwi plans, conceptual framework and/or proposal design, and outcomes.
Delete this text before submission]

Impacts: [Short-term and long-term impacts including translation to practice. These impacts may come beyond the timeframe of the funding provided. Delete this text before submission].

For Projects submitted under Category D: Communication, Education & Engagement (CEE) and Diversity, Equity, Wellbeing & Inclusion (DEWI) Focused Projects – Identify how the project will contribute to the CEE or DEWI goals as Appropriate:

References:

3. Ethics or Regulatory Approvals:

Does this project require ethics and/or regulatory approval(s)?

Yes No

If approvals are required please indicate if you have these approvals or how approvals may affect the project timelines.

[Details of ethics or regulatory approval plans. Delete this text before submission].

4. Project Budget

Transfer the project budget figures from Column J of the relevant sheet in the budget template (available [here](#)) into this section of the Application Form

SALARIES:	
Salaries & Salary-related costs	\$
INDIRECT COSTS:	
Overheads	\$
PROJECT COSTS:	
Direct costs	\$
Travel ³	\$
Postgraduate students	\$
TOTAL PROJECT BUDGET	\$

5. Budget Justification: [Please provide a brief budget justification, outline the size and extent of the budgeted items and how they deliver value in meeting the project deliverables. Delete this text before submission]

6. Project Deliverables: [Each project must have at least two Deliverables (where one deliverable is a peer-reviewed journal publication). This section will be copied into the contract if the proposal is successful and should only include deliverables within the funding period. No changes can be made to the project deliverables during contracting. Please see the FAQs for examples of appropriate deliverables. Delete this text before submission]

Deliverables	Due Date
[Enter deliverables here. Add additional rows as needed. Delete this text before submission]	

³ Where applicable, and where other funding is not available (For example from the coordinated projects), include travel of up to \$1,000 for each key project investigator or student to attend the QuakeCoRE Annual Meetings each year

As a TEC Funded CoRE, a key deliverable that is used to measure the impact and success is research outputs; peer reviewed journal articles. Please indicate in the box below the number or peer reviewed journal articles expected as a result of this project funding.

Peer Reviewed Journal Publication

[Indicate the number of publications in the box below, list the tentative title(s) and target journal(s) here. Please provide estimated due date(s) (submission date) in the right hand column. Delete this text before submission]

Number of Journal Articles [List details below]

Related Research

7. Aligned activities and funding:

[Summarise the aligned funding and activities for this project. This includes research funding from national and international public and private sectors as well as awarded/contestable university support. Please include the funding that this project is aligned to and how this project proposal will provide additionality.]

[Where you believe this project will significantly contribute to the likelihood of future investigator led external research funding, provide a short statement outlining this. Delete this text before submission]

By signing this application form below, I confirm that:

- **This application is consistent with the QuakeCoRE collaboration agreement and has been endorsed by both the applicant and employing organization**
- **If this proposal receives QuakeCoRE funding, the terms and conditions set out in the Collaboration Agreement will be adhered to**
- **All of the people named in this proposal have approved their involvement as written and are committed to supporting a successful project outcome**
-

SIGNATURE:

Date: