BRAC Industry Research Strategy Analysis				
Research Theme	**Research Topics**	**Questions/Points of discussion**	**Related issues identified by BRAC member**	**Other comments (related sources of information and evidence etc)**
Better Buildings	Resilient buildings	• The performance of building systems has come into sharp focus since the Canterbury earthquakes and recent storm and flood events. Further research is required to develop methods for evaluating and rating the resilience of building systems. • Development of new building systems that are resilient to all natural hazards while being cost-effective and sustainable. • Understanding the role of technology in monitoring building movement and structural integrity. • New Zealand's existing building stock will continue to form the bulk of our building stock. Research is required to understand the cost benefit of improving building's performance. • Improved understanding of building and materials behaviour in order to improve resilience and performance. • Research into providing resilience of interior linings and exterior claddings under seismic loading would achieve significant reductions in earthquake damage. The development of solutions in this area could result in housing stock being much more resilient to the natural hazards present in New Zealand. • Improved resilient design of buildings that include, for example, better consideration of the post-elastic performance of buildings.	**> Research needs to understand how the collaboration of Engineers and Architects can deliver innovation and performance improvements (was a recommendation of the Canterbury Royal Commission)** **> Supportive of the focus on the 'non-structural' elements and their resilience and performance.** **> Further work is needed about undertanding the 'resilience' of buildings facilities management**	**> Need to understand building owner behavior - how do you incentivise and/or encourage positive resilience decisions?** **> Work needs to undertaken on the relationship of buildings at various stages of resilience (i.e. building x - resilient, building y - existing building of 1930s, building z - undergoing seismic upgrade).**
	Moisture in buildings	• Managing moisture in buildings remains a key priority for the industry, and a robust calculation basis for moisture design would support improvements in this area. The benefits and requirements of such a model should be explored and, if beneficial, taken forward. • Moisture-tolerant walls, roofs and floors that still meet health, warmth, comfort and durability goals would deliver improvements in building envelope performance for New Zealand homes and business. Work should be carried out to identify relevant material characteristics which would provide such qualities. • In order to improve our understanding of building envelope systems and the impact of changes in one area on the system as a whole, work should be undertaken to develop methods to avoid future moisture-related issues resulting from changes to materials, designs and construction methods. An important component of this is understanding the relationship between indoor and outdoor air quality and moisture, in particular the need to consider airtight buildings and mechanical ventilation as parts of the same building system rather than discrete components.	**> Practical thought needs to be given to the effect of heat pumps on the moisture of buildings, particularly in response to the growing use in Summer. > Given the comment about NZ's building stock continuing to form the bulk of building stock - methods and management of 'moisture' needs to have a focus on existing building stock.**	**> Given the issues to-date in the education space - further research work should be undertaken given the signficant investment planned over the next 10 years.**
	Indoor air quality and moisture control	• Technologies, products and methods to improve indoor air quality. • Technologies and methods to optimise the performance of indoor space-conditioning systems. • Solutions to improve indoor environments to address moisture issues. • Understanding the condition of interior systems in non-residential buildings. • Understanding the drivers of building owner behaviour in order to develop appropriate methods to incentivise the upgrade of interior systems components that negatively impact on the health and wellbeing of occupants. • Methods to understand and measure relevant levels of performance in order to compare di different interior systems.	**> This research work should look at the perspectives of the 'building owner' and the 'building user'.**	
	Ventilation	• As both new and existing homes and buildings become better insulated and more airtight, the importance of understanding the role of ventilation is increasing. How can New Zealand develop better ways to ventilate homes that are more energy efficient and target moisture more directly?		
	Acoustic performance	• Understanding methods for improving acoustic performance without compromising other elements of the building system. • Methods to deliver high-quality acoustic performance in higher-density housing, without compromising useable space. • Understanding the drivers of building owner behaviour in order to develop appropriate methods to incentivise the upgrade of acoustic systems in existing buildings.		
	Fire	• Tools and techniques to ensure that new and existing buildings and structures perform more dependably in fire situations, including post-earthquake fires, at a whole-of-structure as well as an elemental scale. • Tools and techniques to improve levels of risk and uncertainty in fire safety engineering and better providing a sound technical basis for the performance-based regulatory framework in New Zealand. •Understanding the implications of sustainability for fire safety and protection. • Assessing the impact that new technologies could have in improving the cost and effectiveness of fire safety systems. • Improving our understanding of the effectiveness of installations of fire safety provisions in the New Zealand market and how well services are matching specifications.		

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Materials Performance	Performance of systems/effects of new materials on existing materials	• What are optimal building systems for different environments? • How does the performance of different products change when integrated into building systems? • What are the barriers to improving materials performance? • What are the weak links in building systems – where are the opportunities to most improve materials performance?		
	Performance of new materials in existing systems	• What new materials can be developed to improve building performance by enhancing or replacing existing materials? • How do new materials integrate into existing systems?		
	Performance of existing materials in new applications	• How can existing materials be applied in new applications that improve the performance of both the materials and buildings they are used in? • What are robust methods for establishing a performance history?		
	Improving the performance of materials	• What new building solutions will increase building performance while at the same time improve the performance of sectors within the building and construction industry? • To what extent is material quality understood and monitored within New Zealand? Can improved quality assurance systems in the testing and confirmation of material properties be put in place?		
	Product assurance	• Are the pathways and processes for assessing and approving new materials and products for use in contruction working? • What improvements are possible or needed? • What is the appropriate approach to product and material traceability that should be emploved in New Zealand?		
Maintaining and improving the performance of existing buildings	Retrofit solutions	• What retrofit solutions are available to improve building resilience and performance? • What are the tailored retrofit remedies for New Zealand's historic buildings, including unreinforced masonry, row buildings, early concrete construction, heritage and indigenous buildings? • What situations are different solutions best applied to? • What are the interactions between different retrofit methods, and what does this mean in the context of building systems? • What is the value case for retrofit solutions?		
	Building condition	• What is the condition of New Zealand's commercial building stock? • What is the condition of New Zealand's housing rental stock? • How do we best improve the condition of New Zealand building stock? • What are the priority areas for improving conditions? • What are the barriers to improving building condition?		
Sustainability	Measuring sustainability	• What guidance, support and tools are needed in order to help industry to better understand and benefit from sustainability including benchmarking sector performance from a whole-of-life perspective? • How best do we develop New Zealand-specific building and/or building project sustainability assessment tools that are soundly based in science and practices appropriate to this country? • What level of information and analysis is required about the effectiveness of resource amenities (such as energy and water use) in new and existing buildings?		
	New technologies	• How might the application of new technologies improve sustainability in new and existing New Zealand buildings? • How does building design influence occupant behaviour towards or away from sustainable habits? What design features encourage or discourage occupants' resource use? • How do we optimise and integrate multiple technologies and systems to maximise efficient resource use?		
Automation, industrialisation and new technologies	New construction systems and processes	• Modern methods of construction such as advances in offsite manufacture and prefabrication appear to offer benefits throughout the value chain, but are not being adopted as widely as anticipated. • Which forms of technology are delivering the envisaged benefits, in terms of cost savings, labour efficiency and quality improvements? • How do you upskill industry to adopt new construction systems? • How do you change outdated perceptions of construction systems? • What emerging technologies (offshore, onshore, within the industry, external) may have application in the building and construction sector? • How can these technologies be developed for application in the building and construction sector? • What are the most appropriate BIM standards for New Zealand? • How can BIM best be applied to smaller building projects? • How do we bring together BIM and BEIM? What are the current constraints, and how do we overcome them? • How do we incorporate new technology developments into BIM/BEIM in a timely but managed way? • What is the role of product traceability in the domestic market and in the international market? • What are appropriate standards, benchmarks and protocols for the introduction of product traceability into conformance and regulatory processes?		

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Operating environment	Export opportunities	• How can the construction industry capitalise on export opportunities, in terms of both products and knowledge?		
	Health and safety	• How do we improve industry health and safety without adversely affecting productivity and project costs? • Understanding which health andsafety measures work, and why. • How do we improve health and safety performance in the DIY building sector?		
Productivity	Industry structure	• A key starting point is to have a solid understanding of the New Zealand industry – in particular, what is distinctive about the New Zealand building and construction industry, how it is made up and the processes it uses. • This information will in turn provide the basis for research into a number of different elements of the industry's productivity. It will provide insight into the performance of the industry and the factors that may influence this – most notably in providing scope for comparative analysis of both similar industries and other economies.	**> Any productivity measures need to understand the elements around - 'pipeline of work'; scale; scheduling; team assembly, scale up and down costs. > Work should be focused on how do you 'smooth' the construction 'boom' 'bust' cycles.**	
	Productivity measures	•There is also a need for research to better understand how productivity can best be measured in relation to the various aspects of the industry - what are the best measures of industry productivity, company productivity, project productivity and task productivity?		
	Industry processes	• What is stopping New Zealand industry from using more efficient construction processes? • What are the drivers of innovation within the building and construction industry at sector, company and project level? • What is the most effective way to spread innovation and productivity improvements throughout the building and construction industry? • What is the impact of government procurement on industry productivity? • How are activities such as the Christchurch rebuild influencing and changing procurement practices? • What are the barriers to uptake of standardisation of building materials, products and building designs and how can it be made attractive?	**> How do we get insights from International markets on research, innovation (e.g. educational alliances, industry partnerships, etc.)**	
	Skills	• How does the construction industry skills profile change through the boom/bust cycle? • What are the optimal trade skill sets and how are they best kept current? • What is the optimal business/management skill set for the construction industry and how is it best kept current?	**> Design is integral to achieving quality, housing choice, housing needs, efficiencies, etc. Research neds to be undertaken on how to optimise design skills and outcomes in the industry. Design provides the catalyst, opportunity for innovation. How is this harnessed and maximised?**	
	Technology	• What is the potential role for new and existing technologies to increase productivity? • What can we learn from overseas about these technologies? • What is the potential role for information technology in the NZ industry and how should it be introduced? • What lessons for increasing productivity can be learned from other industries, such as the car industry, and applied to the construction industry in New Zealand?	**> Interesting choice of example - car industry (given that they have had large failures, subsidy and tariffs). Is there not an oppportunity to think about the role of technology in the industry - ie. what Amazon is to books and libraries. > Would encourage BRANZ to investigate the cross-over technologies that fit with solutions and improvements to procurement; artifical intelligence; emerging technology; changing user behaviour.**	
	Client value	• How can we help clients understand what's available and how to best meet their needs? • How do we find out what clients value? What incentives are there for a home or building owner to improve the performance and resilience of their building? How does this differ across markets? • How can whole-of-life value and multi-functionality be best factored into client decision-making? • How can the knowledge of end-users as building users be utilised to evaluate performance and understand factors that contribute to success and failure of building use?		

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	Operating environment	• What is the impact of regulation (e.g. the Building Act, Building Code and health and safety requirements) on productivity growth? • How can new technologies help improve knowledge and the effectiveness of regulations and drive more efficient construction processes? • How does the introduction of the LBP scheme improve the performance and quality of the final product? • How will the dramatic shifts in insurance risk dynamics and labour market drivers affect industry and how will industry respond? • How will contract and procurement strategies change in response to shifts in risk appetites and profiles?	**> Suggest a focus on understanding whether 'acceptable' and 'alternate' solutions are working in the market and for the professions involved. Need to understand what obstacles and barriers are occuring to 'alternate' solutions. > Thought is needed on the impact of the Licensed Building Practiticioner (LBPs) scheme. Specific attention is needed on 'quality' how is it assured, delivered and measured.** **> Need to understand what the future needs of the industry and professions involved are (e.g. collaboration, on-site experience, etc.).** **> Evidence is needed on the performance of 'multi-proof' consents - what has it delivered in terms of efficiences; what are the barriers to take-up; how would it's use be expanded; what has it delivered to-date.**	
	Canterbury rebuild	• How are construction processes in the Canterbury rebuild changing as a result of the tight timeframes and special conditions? • What is the change in mix of bespoke compared with standardised design and construction? • How are uptake and integration of innovation changing during the Christchurch rebuild? • How is the Canterbury rebuild changing the supply and demand for materials, skilled people and the skill level of construction workers? • How will sector dynamics shift when responding to the rebuild and how can we embed innovations and efficiencies from the Christchurch experience across the wider industry?	**> Don't agree with the 'bespoke' reference. The Building Act differentiates between acceptable and alternate solutions. Often a non-standard response is needed because of the site. A key issue is the relationship between the building and the land - this has been highlighted in Canterbury, but the current system is not structured in this way.** **> Careful thought will need to be given around what constitutes 'standardised' , particularly post Canterbury earthquake.**	
	Auckland growth	• How are building types changing (e.g. detached housing to apartments)? • How is building quality and fitness for purpose being addressed? • What are the best residential building types for Auckland (e.g. mixed use)?	**> Housing quality is essential and needs to be thoroughly investigated in terms of how it can be incentivised, encouraged, delivered, etc.**	
Meeting the housing needs of all New Zealanders	Population change	• How well do we understand the implications of New Zealand's changing population on housing provision? • What impact could changing household formation patterns have on existing and future housing? • How might internal and external migration impact on different housing markets?		
	Housing an ageing population	• What are the housing needs of an ageing population? How do they differ from the current housing stock? • Impacts of internal and external migration and migration effects of an ageing population – where are people moving to and from and what is the impact of this on demand for housing? How do housing needs differ between different communities? • What is the impact of the growing cohort of 'asset rich, cash poor' on supply, demand and price of particular types of housing?		

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	Housing a diverse population	• How well is our current housing stock catering for New Zealand's ethnic diversity? • As levels of diversity change in coming years, what changes might be needed around the provision of housing?		
	Meeting the needs of vulnerable groups	• What are the current and forecast levels of housing provision for people with vulnerabilities? • How well is this housing meeting the needs of its current and future users? • How well are the needs of vulnerable groups being met by general needs/mainstream housing stock – both existing and new build?		
	Housing tenure	• Changing tenure structures – what are they and how do they affect the make-up of NZ's housing stock, both existing homes and new build? • What are the implications of a greater role for the rented housing market, particularly in different parts of the country?	**> The research needs to understand the relationship between housing needs and housing choice. A lot of the current work is focused singularly on housing needs without understanding the relationship with housing choice. > Research and evidence is needed around the role of subdivision and the procurement of projects (e.g. site-by-site v master planned).**	
	Housing affordability	• How do land prices affect affordability? • What impact do local and national regulatory requirements have on the cost of housing? • What opportunities are there for New Zealand to improve housing affordability? • What roles does affordable (sub-market) housing provision play within this and how best can that be delivered? • What are the short, medium and long-term implications of ongoing housing affordability issues (for example, increased revenue support for households, social pressures)? • How can new approaches to building and construction support improved housing affordability (for example, improved productivity through offsite construction, supply-chain innovation, development of affordable materials and systems etc.)?	**> Is this work, "What opportunities are there for New Zealand to improve housing affordability?" a double up given the Producitivity Commissions work?**	
Building better cities and communities		• How do we deliver cities that meet the aspirations of residents, are affordable and liveable, while at the same time increasing density? • What role can the built environment play in contributing to cities that support New Zealand's international competitiveness? • How can buildings enhance vibrant city environments? • How is the Christchurch rebuild changing attitudes and approaches to urban revitalisation, and how can we apply these lessons elsewhere? • How do we integrate urban planning requirements at a city level with individual property rights? • What kind of medium and high density housing is best suited to New Zealand's social, economic and environmental conditions? • How best can we create neighbourhoods, towns, cities and regions that work for current and future needs, given that the majority of future buildings and infrastructural assets are already in place?		