

Charlotte Brown - Web form submission

Critical Infrastructure Resilience

What is your name?

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Are you responding as an individual or on behalf of an organisation?

Resilient Organisations

Do you consent for your submission (including identifying information) to be published and shared in lines with terms for this public consultation?

Yes

Do you consent for your submission (including identifying information) to be published and shared in lines with terms for this public consultation? - Please note what should be withheld and for what reasons.

[Nil]

Does more need to be done to improve the resilience of New Zealand's critical infrastructure system?

Undoubtedly yes. Our infrastructure is aging, the threats and hazards we face are growing and there is inadequate investment in maintenance, improvement and replacement of our critical assets. In addition, there is a wide range of maturity and capability amongst critical infrastructure providers, leading to variable performance across critical infrastructure systems. The variable performance across both asset types and locations means that the socio-economic benefits of resilience investments, are not always realised, due to cross-sector dependencies.

Have you had direct experience of critical infrastructure failures, and if so, how has this affected you?

Resilient Organisations (www.resorgs.org.nz) has been researching the impact of critical infrastructure service disruption on organisations and communities for over a decade. We have a deep understanding of how organisations are affected by, and adapt to, infrastructure disruptions. Much of this work is integrated into the economic modelling tool, MERIT (www.merit.org.nz) we co-own with GNS Science and Market Economics.

We are driven to ensure critical investment decision making efficiently and effectively maximises benefits to communities.

How would you expect a resilient critical infrastructure system to perform during adverse events?

Infrastructure service levels meet the needs of the affected community. These needs, and therefore levels of service, will change over time as tolerance to disruption and ability to defer certain activities changes over time. Performance needs to be defined at community scale.

Would you be willing to pay higher prices for a more resilient and reliable critical infrastructure system?

Yes. We should also be subsidising those communities that cannot afford the services they need. That said, we need to be much smarter and targeted in the infrastructure investments we make. We cannot just raise standards across the board as the costs of this will likely be too great. We need a deeper understanding of where the greatest needs are and invest there, coupled with enhanced readiness, response and recovery capabilities for situations where we accept a higher level of service disruption.

We cannot build our way to resilience. We must take a systems approach.

The work programme's objective is to enhance the resilience of New Zealand's critical infrastructure system to all hazards and threats, with the intent of protecting New Zealand's wellbeing, and supporting sustainable and inclusive growth. Do you agree with these objectives? If not, what changes would you propose?

Generally yes.

Do you agree with the proposed criteria for assessing reform options? If not, what changes you would propose?

Criterion A should be framed around the end goal- ie wellbeing. "How well does the option enhance community resilience". 'Infrastructure resilience' is not an end unto itself. If we frame it this way, then we risk investing indiscriminately, with the objective of enhancing the assets, rather than enhancing the services in a way that best support the communities that use them.

Do you think the megatrends outlined pose significant threats to infrastructure resilience?

Yes

Are there additional megatrends that are also important that we haven't mentioned? If so, please provide details.

While likely not classified as a megatrend, inequality is a critical (and growing) issue that needs to be considered, particular when considering the delivery of critical services to meet basic human needs and who can and should pay.

Do you think we have described the financial implications of enhancing resilience accurately? If not, what have we missed?

While the principle behind cost being borne by predominant beneficiaries is sound, this may be hard to do in practice, particularly where there is an indirect link between service provision and benefit.

Tourism infrastructure is an example of this – where the benefit is largely felt by transient populations. Instances where benefits are felt through a chain of infrastructure dependencies may also make this challenging.

Complicating matters is that the day to day benefits can sit separately to the post-event benefits. For example where investment is specifically made to support emergency-level provisions or disaster recovery rather than day to day socio-economic activity.

How important do you think it is for the resilience of New Zealand's infrastructure system to have a greater shared understanding of hazards and threats?

Very important.

If you are a critical infrastructure owner or operator, what additional information do you think would best support you to improve your resilience?

[Nil]

What do you think the government should do to enable greater information sharing with, and between, critical infrastructure owners and operators?

Provide the technology to do so easily and securely. As well as the technical and financial support to help agencies transition to shared data standards and operating platforms.

Would you support the government having the ability to set, and enforce, minimum resilience standards across the entire infrastructure system?

Yes, if done appropriately, in a way that meets the variable needs of the community.

In the discussion document you asked: "what type of standard would you support (e.g. requirement to adhere to a specific process or satisfy a set of principles)?" Our response is below.

While undoubtedly harder to implement and regulate, a principles based approach is likely to be a better approach given the complex and context specific nature of infrastructure system resilience. The nature of hazards and their impacts are dependent on the geographic location, spatial extent/layout of network (including degree of redundancy), degree of dependencies, affected community, economic activities affected, capacity/timeliness to restore services etc. This complexity can be modelled but is likely hard to codify.

If we take a process approach (and the process cannot cope with the complexities of these interdependent, complex networks) there is a risk that we will over invest in areas of the infrastructure system that do not need the investment that other areas do. Initiatives need to be based around biggest risk, an accepted risk tolerance and minimum acceptable levels of service (which is linked to context). Infrastructure importance (and desired levels of service) needs to be contextualised beyond the number of customers affected but to understand the nature of the customers, the nature of the community affected, the cascading impacts, the ability to recover/rebuild.

We think it is important to learn lessons about how minimum standards are perceived and play out in other parts of our regulatory system. There is a lot of work underway at the moment around the seismic performance of buildings. There is growing evidence that there is misconception over what the Building Code delivers. Many consumers believe that the Code is the gold standard and that there will be no (or little) damage after an earthquake. The Code, currently, predominantly focusses on life safety. Ongoing use/functionality is only considered in limited cases. The introduction of reductionist metrics like %NBS have cemented and further blurred the public's understanding of building performance. And this has flowed on to how residential and commercial tenants make leasing decisions and what building owners seek when commissioning new buildings. And now we have a system seeking minimum performance rather than seeking the best outcomes.

An outcome based approach ensures that the regulatory system is talking the language of the end users and reinforces to decision makers the objectives of how they manage their system.

Whatever approach is taken, it is important that the means to which the end outcome is achieved should not be specified. We need to be flexible in the solutions we allow. For example resilience does not have to be gained through robustness alone. Redundancy, readiness and recovery are all elements of a resilient infrastructure system. For example, the Waiho bridge in Franz Josef is a permanently temporary structure. Due to the costs, risks and technical challenges involved, a Bailey bridge is used on a permanent basis, on the understanding that it will fail and be replaced by a second bridge on standby. This solution meets the needs of the users, without the prohibitive costs.

Related to this point, the organisational capabilities of the entities that run these assets is critical in how we assess resilience. It is disappointing to see this excluded from this initiative. We cannot build our way to resilience, we simply do not have the resources. In addition, the uncertainty we are facing means that we simply cannot predict what our system will face in the future. There will always be an element of response and reaction, which is primarily an organisational process. If we are going to look holistically at resilience, and utilise the multiple pathways to achieving resilience, then we need to support and enhance the capability of these organisations.

Would you support the government investing in a model to assess the significance of a critical infrastructure asset, and using that as the basis for imposing more stringent resilience requirements?

The complex and interdependent nature not only of infrastructure systems themselves but the socio-economic system that these systems supports, means criticality is hard to understand without a deep understanding of this complex system. There are models available in New Zealand that can link end to end the failure of critical infrastructure assets to socio-economic outcome (at industry and household level). MERIT (www.merit.org.nz) coupled with RiskScape (GNS/NIWA) or Urban Intelligence's The Risk Explorer (<https://urbanintelligence.co.nz>) can achieve this end to end modelling. Using this modelling capability would be a good way to evaluate how the performance of one asset cascades to the impact on the community.

That said, criticality also needs to be determined by the end users – the community. What levels of service are needed? What is acceptable? What is not?

What criteria would you use to determine a critical infrastructure asset's importance? Investing in a model to assess a critical infrastructure asset's criticality, and using that as the basis for imposing resilience requirements that are more stringent on particularly sensitive assets?

Our understanding is that the intent of this initiative is focused on nationally critical assets only. We think that this might be limiting to the point that the initiative does not achieve what it set out to do. Cyclone Gabrielle is cited in the consultation document Forward and in the DPMC consultation presentations as an event that has demonstrated the need for this initiative. However, (depending on the final definition) there are very few assets that immediately fall into 'assets of national significance' category.

Criticality is deeply contextual. It is arguably not something that can be determined in a top down process alone, but needs to be characterised by the community that is being affected. Some communities have greater tolerance to deal with disruption than others.

Below is an extract from recent advice we have issued (in partnership with others) to critical infrastructure providers responding to the North Island Extreme Weather Events (see https://www.resorgs.org.nz/wp-content/uploads/2023/07/NIEWE_critical_Infrastructure_resilience.pdf).

"There are many dimensions of criticality that can be considered individually or in combination:

- The importance of infrastructure assets to the overall functioning (business-as-usual) and well-being of the community, including consideration of cultural significance.
- The importance of infrastructure assets and networks to future recovery processes, which may differ from their typical day-to-day importance.
- The number of people served and the significance of the user's needs (including critical customers such as hospitals and civil defence centres).
- The upstream and downstream dependencies between different infrastructure assets and sectors. Failure of infrastructure systems your asset/network requires to function (upstream dependencies) can nullify any interventions you implement. Downstream dependencies can exacerbate impacts of failure, through cascading impacts on other critical infrastructure systems.
- The vulnerability of the community and its capacity to withstand loss of service and/or recover from disruption. Areas that don't have resources or are particularly vulnerable may be more important to service."

In addition, when evaluating criticality, the rapidly changing hazard and community landscape (being shaped by rising seas and increased flooding events) needs to be considered. Our communities are rapidly changing and the criticality of assets to these communities and the economy will also change with these. This future uncertainty needs to be built into how we assess criticality and the transition path from today to tomorrow needs to be accounted for.

Do you think there is a need for the government to have greater powers to provide direction or intervene in the management of significant national security threats against a critical infrastructure? - Is there a need for greater powers? If so, what type of powers should the government consider? What protections would you like to see around the use of such powers to ensure that they were only used as a last resort, where necessary?

[Nil]

Do you think there is a need for a government agency or agencies to have clear responsibility for the resilience of New Zealand's critical infrastructure system?

A single, new entity seems appropriate.

Do you think there is a need for compliance and enforcement mechanisms (eg. mandatory reporting, penalties, offences) to ensure that critical infrastructure operators are meeting potential minimum standards?

[Nil]

What additional comments do you have?

Below are some of the key considerations for embedding resilience in infrastructure management, planning and investment decision making.

UNDERSTANDING THE SYSTEM

Systems approach:

Infrastructure planning should be based around an understanding of the infrastructure system, its users, and its deficiencies, not around single projects addressing singular issues. A wider system view is required to inform decisions and develop options and actions. Decisions must be first and foremost driven by an understanding of the communities' service requirements. Second, decisions must be informed by the physical, spatial, logical and technical dependencies across networks. Interventions need to understand both their impacts on and benefit to the wider system.

Acceptance of variable levels of service:

Our resilience needs are many but our resources are constrained. Some communities and locations arguably have higher infrastructure performance needs than others (e.g. those with marginalised communities, geographically isolated or with critical industries). We need to more clearly defined community specific levels of service and corresponding asset/network performance expectations.

Integrated analysis of investment priorities within regions:

Resilience benefits can only be realised if they account for cross-sector dependencies so that one systems' failure does not void another's resilience enhancements. Regional development of infrastructure investment cases based on vulnerabilities and investment benefits (like the 2018 Wellington Lifelines Programme Business Case) can ensure resilience investments can be appropriately prioritised and sequenced and dividends can be realised.

Capturing wider implications of investments:

Investment decisions often focus on local benefits and impacts, instead of looking more broadly to the capture the multi-region and national scale implications. As infrastructure systems and their functionality can affect wide geographic areas the national connectivity across networks needs to be taken into account. A narrow focus on local benefits and impacts can lead to an incomplete picture and lead to ineffective investment decision-making.

IDENTIFYING INTERVENTION OPTIONS

Interventions with co-benefits:

Some communities do not have enough resources to meet their daily needs, let alone prepare for hazards and disruption. We need to look for opportunities to develop resilience and simultaneously

improve quality of life for some communities. For example where isolation is an issue, instead of fortifying access routes we could look for opportunities to build the capacity of the community to withstand isolation for periods and provide benefits everyday (local food production, health care services, improved communication links to support remote schooling)

Climate change ready investments:

Investment decisions should account for the effects of climate change – in particular, isolation of communities, likely retreat and increased hazard events. Provision of temporary or short term management measures (with lower levels of service/robustness) may be suitable where climate change effects are likely to change the way infrastructure is used/needed, before a permanent network re-alignment is determined.

Adaptable solutions:

Related to the above, investments should be valued based on their capacity to adapt to changing environments including climate change but also changing community needs, demographics, technology changes etc. Investments that provide opportunity for future change/adaptation are valuable. For example networks that are readily reconfigured to move with shifting communities.

Emerging technology:

Options and funding need to incorporate the emergence of new technology. As network technology evolves the resilience of wider networks can either improve and worsen. This evolution of technology needs to inform any investment decisions.

Decentralised solutions:

Options and funding need to incorporate decentralised solutions alongside centralised resilience building efforts. Infrastructure investments are often centred on traditional networked assets. Isolation is going to be increasingly present following extreme weather events and hazards such as earthquakes. Providing decentralised infrastructure (e.g. point of use water, energy production) can reduce the impacts of isolation.

MAKING GOOD QUALITY DECISIONS

Funding mechanisms:

Traditional investment decision tools (such as benefit cost analysis) rarely value resilience benefits as discount rates that are applied diminish the value of longer term (or low probability) benefits, such as those that are realised following a hazard event. They also do not account well for uncertainty – where the extent and nature of benefits cannot be well described (or easily monetised). We need improved decision evaluation processes and tools that can better value the full benefits of resilience. In addition, we need new funding mechanisms that specifically value the resilience dividends of critical infrastructure. Can new mechanisms be explored to support resilience investments?

Shifting from reactive to proactive:

New Zealand is caught in a fairly constant state of reacting and responding to natural hazard events that have had significant, wide-reaching impacts. Rather than investing this money proactively by maintaining and improving our infrastructure systems prior to an event, most of the effort has been invested in reacting and recovering following events

This has influenced the balance of short vs long term thinking, preventing longer term thinking and diverting funds away from longer term projects. Could there be diversification/support of teams/roles so that the proactive planning can take place, without being affected by the reactive needs? Alternatively or additionally, future investment scenario planning could be explored as part of BAU investment/asset planning. Linked to urban development and land use planning, this could explore the impacts of hazard events, climate change and other community changes and what

opportunities could be taken to improve infrastructure systems through the recovery process following events. Doing this thinking before an event will enable more strategic use of funding and resources following a disruptive event – ensuring recovery investment is forward focussed, rather than a race to build back what was there.

Data and use of data:

Much of the decision making and system performance assessment described above relies on quality data. Effective decision making relies on a shared operating picture across infrastructure networks (both current and future planned state). This helps to ensure dependencies are understood and integrated into investment option identification, analysis, and decision making.