A Pathway to Infrastructure Resilience
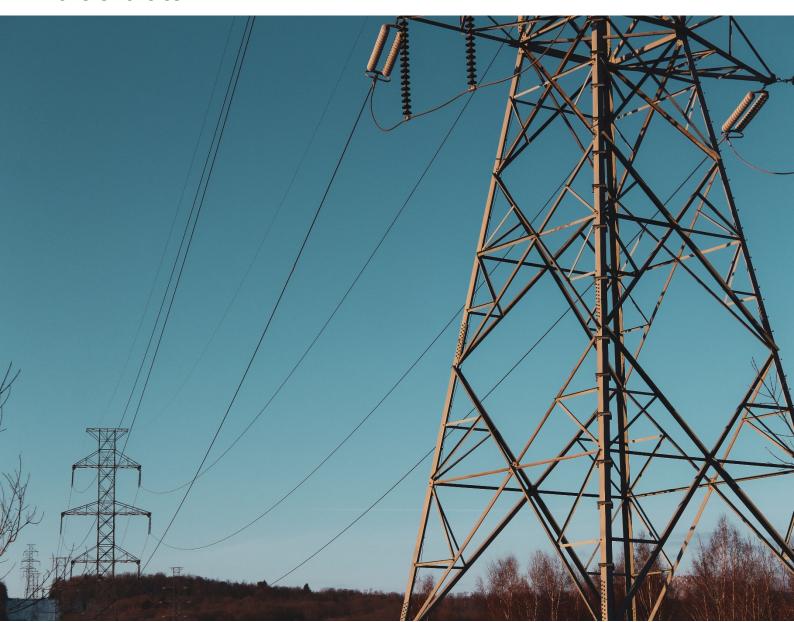
Advisory Paper 2: Guidance for asset owners and operators in the short term

Australian Government | **Infrastructure Australia**

we are **insw** Infrastructure New South Wales

This report was developed in collaboration by Infrastructure Australia and Infrastructure NSW.

Infrastructure Australia is an independent statutory body that is the key source of research and advice for governments, industry and the community on nationally significant infrastructure needs.

It leads reform on key issues including means of financing, delivering and operating infrastructure and how to better plan and utilise infrastructure networks.

Infrastructure Australia has responsibility to strategically audit Australia's nationally significant infrastructure, and develop 15-year rolling infrastructure plans that specify national and state level priorities.

Infrastructure New South Wales was established in July 2011 to assist the NSW Government in identifying and prioritising the delivery of critical public infrastructure for NSW and to ensure that decisions about infrastructure projects are informed by expert professional analysis and advice.

It is a NSW government agency established under the Infrastructure NSW Act and it exhibits important features of independence.

Contents

Executive Summary

Infrastructure Australia and Infrastructure NSW undertook the *Pathway to Infrastructure Resilience* research project based on a shared vision for a resilient future, where Australian communities can recover, transform and thrive in response to shocks and stresses, to realise positive economic, social and environmental outcomes.

The research found that in an infrastructure context, achieving resilience requires a shift in focus from the resilience of the asset itself, to the contribution of assets to the resilience of the overall societal system – what we call *infrastructure for resilience*. This approach requires consideration not only of how to strengthen the asset, network and sector, but also how to strengthen the place, precinct, city, and region that the infrastructure operates within. It requires considering the role of each asset within the broader network and/or system and a shift from individual to shared responsibility.

The research showed that in general, asset owners and operators are seeking guidance for actions they can take immediately towards *infrastructure for resilience*. This paper responds to that need and suggests practical and targeted guidance for asset owners and operators across 40 actions that can be implemented in the short term. It includes guidance applicable to all infrastructure sectors, as well as sector specific guidance for the energy, housing, telecommunications, transport, waste and water sectors.

This paper is the second of two technical papers produced by the *Pathway to Infrastructure Resilience* joint-research project. *Advisory Paper 1: Opportunities for systemic change* outlines in further detail the analysis and context for the guidance in this paper.

Introduction

Guidance for asset owners and operators

Infrastructure asset owners and operators have a critical role to play in ensuring that their assets and networks can withstand shocks and stresses. Our research showed that in general, asset owners and operators are seeking guidance for immediate actions towards *infrastructure for resilience*. This paper answers that need and provides guidance on steps to take in the short-term to support a longer-term journey to *infrastructure for resilience*.

The guidance in this paper is applicable for infrastructure asset owners and operators across all sectors and across all states and territories. However, in doing so, it is acknowledged that some sectors, and some states and territories, are further progressed and well on their way to *infrastructure for resilience*.

The paper **outlines best practice guidance** suggested as an embarkation point for investigation by each owner and operator specific to their own circumstances. In applying the guidance, asset owners and operators will need to develop their own implementation plan.

The guidance supports asset owners and operators in considering the resilience of their assets within the broader system that they operate, including their relationships with other operators and communities.

- To that end, the guidance encourages asset owners and operators to establish a shared understanding of:
  - the role of assets in the delivery of essential services
  - critical interdependencies between assets (of the same network and others)
  - vulnerability to likely shocks and stresses
- collaboration across sectors, with community, and the Australian, state, territory and local governments, and
- capabilities to support understanding and collaboration across the system.

In this paper, **Section 2** outlines guidance applicable to all infrastructure sectors. **Sections 3 – 8** outline sector specific guidance, where applicable, for the following key sectors:

- energy

- housing
- telecommunications
- transport
- waste
- water

Specific guidance was not produced for all infrastructure sectors. Any asset managers or owners in sectors not specifically covered should refer to the guidance in Section 2.

Pathway to Infrastructure Resilience

Resilience focuses on enhancing the performance of a system in the face of multiple shocks and stresses that can occur on an individual, concurrent or compounding basis.

Infrastructure Australia and Infrastructure NSW undertook the *Pathway to Infrastructure Resilience* research project based on a shared vision for a resilient future, where Australian communities can recover, transform and thrive in response to shocks (such as bushfire and flood) and stresses (such as social cohesion), to realise positive economic, social and environmental outcomes.

The research found that in an infrastructure context, achieving resilience requires a shift in focus from the resilience of the asset itself, to the contribution of assets to the resilience of the overall societal system – or *infrastructure for resilience*. This approach requires not only strengthening the asset, network, and sector, but also strengthening of places, precincts, cities, and regions.

This is a step-change from traditional approaches of attempting to prevent or mitigate the loss of individual assets due to specific events. These traditional risk management approaches fail to consider systemic risks that emerge from compounding shocks or stresses and apply to the entire system of physical assets, organisations and communities.

Therefore, to achieve *infrastructure for resilience*, asset and network owners and operators need to act collectively as well as independently, and to collaborate with the community, emergency responders, local, state and territory governments, and the Australian Government around places and communities.

This approach also requires increased emphasis on building organisational resilience and personnel capabilities, as well as promotion of a learning culture. It also means a renewed focus on building resilience of communities.

As a result, the guidance in this paper is sorted into the following categories of resilience:

- **Infrastructure resilience** - the resilience planned for, designed, and built into assets, networks and systems.
- **Organisational resilience** - the resilience of the organisations, personnel and processes supporting infrastructure to supply a service.
- **Community resilience** - the role the community plays in building and maintaining its own resilience while contributing to infrastructure resilience.

These categories align with the National Critical Infrastructure Resilience Strategy 2015[1], and the NSW Critical Infrastructure Resilience Strategy 2018[2].

See *Advisory Paper 1: Opportunities for systemic change* for further detail.

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[1] Australian Government Department of Home Affairs 2020, Critical infrastructure resilience, Australian Government, viewed 2020, www.homeaffairs.gov.au/about-us/our-portfolios/national-security/security-coordination/critical-infrastructure-resilience

[2] NSW Government, 2018, Critical Infrastructure Resilience Strategy, https://www.emergency.nsw.gov.au/Documents/publications/policies/NSW%20Critical%20Infrastructure%20Resilience%20Strategy%202018.pdf

How this guidance was developed

The *Pathway to Infrastructure Resilience* research approach involved collaboration with experts across Australia from government, industry, peak body representatives of the infrastructure and land use sectors, as well as academia and civil society organisations. This partnership approach was taken in recognition of the critical role of collaboration in building resilience across infrastructure assets and sectors with the community.

Expert stakeholders were engaged through 16 workshops focused on a range of shocks and stresses and infrastructure sectors. Over 600 individuals from across Australia contributed. Specific, specialist expertise, as well as best practice examples, and international and local research was also used to refine the guidance. Finally, the guidance in this paper was tested with a range of industry stakeholders from infrastructure sector peak bodies as it was developed.

See *Advisory Paper 1: Opportunities for systemic change* for further detail.

Guidance for all infrastructure sectors

This section provides guidance for asset owners and operators across all infrastructure sectors that can be applied in the short-term.

It is acknowledged that some sectors, and some states and territories, are further progressed and well on their way to *infrastructure for resilience*. Therefore, the guidance is aimed at the average status of asset owners and operators across the nation and consequently, may vary in its applicability in individual circumstances.

The guidance is categorised into the three categories in *infrastructure for resilience* – infrastructure resilience, organisational resilience, and community resilience.

This section provides guidance that can be applied in the short-term. *Advisory Paper 1: Opportunities for systemic change* can be used to determine the longer-term actions your organisation can take to support *infrastructure for resilience*.

It is recommended that ex-post evaluations are completed by asset owners and operators to determine the success and value-for-money of the investment in resilience programs undertaken.

Resilience category	Guidance

Infrastructure Resilience	1. Improving the resilience of key infrastructure assets
	
	   a. *Assess exposure of key assets:*
	
	   For key assets, identify natural and non-natural shocks to which the assets may be exposed, and whether the assets rely on other services that may be affected by these shocks (e.g. external power supply and access routes).
	
	   Key assets should be selected based on suitable, self-determined criteria such as high-risk locations, highest replacement value, or asset importance for emergency services in previous shock events.
	
	   b. *Determine consequence of service disruption:*
	
	   Determine impact and consequences of service disruption of key assets by understanding the role of the assets in a shock event (e.g. place of refuge, sources of water for firefighting) and identifying the impacts of asset service interruption on asset user groups, in particular the most vulnerable user groups (e.g. older, less mobile, lower income, and non-English speaking).

c. Increase resilience of key assets:

To increase the resilience of key assets, collaborate with local and state emergency services and affected community members on emergency preparedness planning to explore options for the asset to reduce exposure to these impacts.

In addition, assess if there is suitable redundancy to ensure operation during emergencies and consider investment to embed redundancy in capital planning.

Finally, confirm asset management plans include the following:

- natural and non-natural hazard exposure

- the impacts on asset performance and actions to increase resilience are up to date and available to all involved in the management and operation of the asset

- how the plans will inform procedures and operations

d. d. Apply the Australian Disaster Resilience Lesson Management Handbook:

Apply the Australian Disaster Resilience Lesson Management Handbook to support lessons learnt processes by considering past shock events and asset failures. In addition, reflect on these events to identify what went well and what could be improved, including any interdependencies with other sectors or stakeholders.

2. Prioritise adoption of appropriate communication, monitoring and analytics technology (e.g. remote monitoring/operation of assets, forecasting trends to anticipate asset failure) that will support improved performance in shock and stress events. Identify technology gaps compared to leading exemplars of comparable scope to the organisation.

3. Where applicable, engage with First Nations land management practitioners, and investigate adoption of traditional First Nations land management in high-risk areas to increase asset protection.

4. Ensure that Service Level Agreements with contractors and service providers for critical services align with minimum service requirements.

5. Review operational/material supply chains for vulnerabilities, drawing on lessons learnt from recent drought, bushfire and pandemic events. Consider the need for local supply options and improved storage of spare items.

Organisational Resilience	6. Review current levels of organisational resilience based on technical standard "*ISO 22316:2017 Security and resilience — Organizational resilience — Principles and attributes*" and develop an action plan to lift practice to meet the standard.
	7. Benchmark existing risk management practices against best practice considerations of resilience in risk management (e.g. guidance from the National Disaster Risk Reduction Framework and discipline-specific guidance, such as SCARM Report 73).
	8. Establish a Resilience Committee (along the lines of existing internal Safety and Quality Committees) to drive cultural, process and procedural change towards resilience, develop internal learning and training programs, and provide oversight, support and reporting to boards and executive

	management. This Committee should also be responsible for the establishment of knowledge hubs, mentoring programs and staff exchanges.
	9. Design and deliver training to inform, upskill and empower operational staff to act decisively and autonomously in the event of a shock event.
	10. Identify capacity and/or capability gaps across the organisation that could arise during emergencies that could be filled by partnerships, including potential partnerships with the Australian Government, state-governments or private sector (for example, Australian Defence Forces or emergency management agencies).
	11. Invest in training to build personal resilience across all staff, and train leaders to promote and monitor personal wellbeing and mental health for staff involved in responses to shocks or stresses.
Community Resilience	12. Engage asset user groups and stakeholders that have been impacted by shock events in the past to understand how shocks and stresses could impact on key services they receive and their minimum service expectations during an event.
	13. Review emergency management and preparedness planning and stakeholder engagement, with close collaboration with the relevant local emergency management committees, to better prepare for future events.
	14. Investigate development of a real-time information system for customers on asset service availability.

Energy sector guidance

Energy infrastructure includes generation, transmission and distribution networks. This sector provides a critical service for the activities of residential, commercial and industrial customers across Australia. Assets include power stations, production facilities, towers, poles, overhead and underground wires, substations, pipes, and compressor stations.

A high level of energy reliability is essential as the service underpins the economy, life safety and is a vital component of daily function. The continued operation of energy infrastructure is a significant contributor to community resilience.

As further outlined in Advisory Paper 1, the management of multiple interdependencies between sectors is essential to prevent cascading impacts. The delivery of electricity is critical for the continuity and performance of telecommunication services. This guidance is suggested for energy sector asset owners and operators across all states and territories. However, it is acknowledged that parts of the sector in some states and territories may be more progressed than others, and consequently, the guidance may vary in its applicability in individual circumstances.

This section provides guidance that can be applied in the short-term. *Advisory Paper 1: Opportunities for systemic change* can be used to determine the longer-term actions your organisation can take to support *infrastructure for resilience*.

Resilience category	Guidance
Infrastructure Resilience	15. Investigate the need for stand-alone power systems for at-risk communities and other critical assets such as telecommunication services, to increase resilience of energy supply.
	16. Reduce the potential for supply chain disruption by considering the need for decentralising spares storage, alternative supplies for critical assets, and undertake scenario planning to identify and mitigate supply chain constraint points.
Organisational Resilience	17. Investigate the potential for sharing and utilisation of technicians between asset operators in emergency situations.

Housing sector guidance

The housing sector is essential for buildings community resilience and reducing the impacts of ongoing stresses that are typically exacerbated by shocks.

Assets in this sector can be owned, operated and maintained by state, territory and local governments, or community and non-government organisations, as well as private sector owners and contractors. As asset owners and operators, local governments and community/non-profit organisations often have a close connection to their communities and knowledge of the social services available in their area.

This guidance is suggested for housing sector asset owners and operators across all states and territories. However, it is acknowledged that parts of the sector in some states and territories may be more progressed than others, and consequently, the guidance may vary in its applicability in individual circumstances.

This section provides guidance that can be applied in the short-term. *Advisory Paper 1: Opportunities for systemic change* can be used to determine the longer-term actions your organisation can take to support *infrastructure for resilience*.

Resilience category	Guidance
<u>Infrastructure Resilience</u>	18. Review current asset portfolios and audit asset stock to identify assets that do not comply with current statutory asset protection requirements from shocks. Use this information to inform the planning and implementation of asset maintenance, upgrades and/or replacement programs.
<u>Community Resilience</u>	19. Assess the level of preparedness of tenants (whether they know what to do in the event of different emergencies, who to contact, and how to prepare their home and households) and deliver education and communication campaigns to strengthen preparedness where required. Work with peak bodies to identify opportunities to roll out consistent campaigns at scale.

Telecommunications sector guidance

Telecommunications infrastructure includes networks that carry voice and data across Australia and beyond. Assets include wires, fibres, towers, sensors, satellites, and cable landing stations. In some situations, telecommunications assets such as towers and fibre may be owned by third parties (for example, nbnCo and Axicom) rather than carriers (for example, Telstra and Optus). The end user typically interacts with the carrier to access services.

Telecommunications infrastructure enables communities to connect and communicate. A high level of connectivity underpins the Australian economy and is a vital component of daily function. The continued operation of telecommunications infrastructure facilities is critical to emergency response and contributes to community resilience, particularly for small towns and rural communities.

This guidance is suggested for telecommunications asset owners and operators across all states and territories. However, it is acknowledged that parts of the sector in some states and territories may be more progressed than others, and consequently, the guidance may vary in its applicability in individual circumstances.

This section provides guidance that can be applied in the short-term. *Advisory Paper 1: Opportunities for systemic change* can be used to determine the longer-term actions your organisation can take to support *infrastructure for resilience*.

Resilience category	Guidance
Infrastructure Resilience	20. Evaluate the need and availability of back-up systems (for example, Cell on Wheels units, Satellite-connected Cell on Wheels, Mobile Exchange on Wheels and Rapid Deployment Units), as well as the logistical support and human resources needed to enable the continued operation of telecommunication assets under various outage scenarios.
	21. Investigate the potential to harmonise hardware and inventory for back-up systems in accordance with a common standard (Australian Standard or equivalent) to support ease of deployment.
	22. Investigate potential for seasonal leasing programs for stand-alone infrastructure that augments capacity/capability in high risk periods (e.g. satellite broadband).
	23. Investigate the development and sharing of visual records of network assets with associated service providers and emergency services (e.g. technology such as Lidar can be used to develop a digital, 3D representation of network assets and vegetation in bushfire prone areas).

	24. Investigate options to improve the resilience of critical reliance services such as energy supply and backhaul services.
Organisational resilience	25. Investigate the potential for sharing and utilisation of technicians between asset operators in emergency situations.

Transport sector guidance

Transport infrastructure refers to pedestrian, cycle, public transport, road and freight networks as well as ports and airports. A reliable transport system is fundamental to keeping communities safe, connected and secure in the event of disruption. The transport network enables the movement of essential goods, supplies, services and people and is key to the integrity of supply chains. Disruptions to the transport network and services can have far-reaching social and economic implications.

Transport infrastructure operators have a key role to play to minimise the impacts of these disruptions by facilitating access for first responders and affected communities. It is important that the transport system is coordinated with other sectors to establish consistent and data-informed decision –making. It must also be flexible so that systems can change, evolve and adapt to dynamic circumstances, and be built with sufficient redundancy to accommodate disruption.

Transport infrastructure assets and services are generally owned and maintained by state, territory and local governments. However, there are also privately owned and operated facilities, such as private roads and some toll roads.

State and territory governments working with local governments should implement the following actions in collaboration with private landowners and operators where appropriate. However, it is acknowledged that parts of the sector in some states and territories may be more progressed than others, and consequently, the guidance may vary in its applicability in individual circumstances.

This section provides guidance that can be applied in the short-term. *Advisory Paper 1: Opportunities for systemic change* can be used to determine the longer-term actions your organisation can take to support *infrastructure for resilience*.

Resilience category	Guidance
Infrastructure Resilience	26. Identify constraints on evacuation routes in vulnerable parts of the transport network (such as bushfire or flood-prone areas).
	27. Assess whether suitable external power or telecommunication redundancy is available for signalling, lighting and other equipment needed for evacuation routes identified in bushfire and flood-prone areas.
	28. Consider opportunities to pilot tools such as the CSIRO Transport Network Strategic Investment Tool for planning evacuation routes.

	29. Develop regional transport resilience plans in key locations by setting up inter-governmental regional working groups to identify measures to improve reliability and resilience of the transport network in those locations.
Organisational Resilience	30. Review existing governance arrangements between transport agencies, local government and other asset owners and operators to improve coordination for evacuation planning.
Community Resilience	31. Investigate the development of a pilot, real-time information system that includes information on network capacity and evacuation routes to aid customer decision-making and mode/route choice.

Waste sector guidance

Waste infrastructure includes all infrastructure involved in waste collection, disposal, and resource recovery. Assets include transfer stations, materials recycling facilities and landfills. The waste industry provides an essential service and caters for clean-up activities as part of recovery efforts. Ensuring that critical waste infrastructure is available during these times is paramount for an effective response that protects public health, the environment and community resilience.

Waste facilities can be owned, managed and operated by local government, the private sector or a combination of the two, and may be delivered by a range of delivery models. Private sector owners and operators may also interface with the local government, (for example, through tendering for the contract for the collection of kerbside waste) and/or serve commercial customers.

This guidance is suggested for waste asset owners and operators across all states and territories. However, it is acknowledged that parts of the sector in some states and territories may be more progressed than others, and consequently, the guidance may vary in its applicability in individual circumstances.

This section provides guidance that can be applied in the short-term. *Advisory Paper 1: Opportunities for systemic change* can be used to determine the longer-term actions your organisation can take to support *infrastructure for resilience*.

Resilience category	Guidance
Infrastructure Resilience	32. Identify critical waste assets and their location, location of alternative facilities, potential vulnerabilities to better understand the waste infrastructure network and any interdependencies in the event of a shock and need for disposal of material.
	33. Investigate and identify the options (e.g. emergency storage) for waste disposal generated following shock events in areas where alternative waste facilities are not available.
Organisational Resilience	34. Prepare, in advance, the waivers to licences and/or planning consents that may be needed to respond to an emergency to enable safe disposal of waste materials. This should be done in collaboration with communities, regulators and planning authorities.
	35. Establish roles and responsibilities with regulators and agencies in the event of an emergency.

36. Continue to engage directly with regulators in long-term strategic planning and maintain engagement with peak bodies to have waste recognised as an essential service.

37. Ensure that Service Level Agreements with all sub-contractors for critical services align with minimum service requirements to reinforce a focus on the delivery of services to the community and ensure that service delivery expectations are clear.

38. Work with peak bodies to share lessons learnt with other waste operators (for example, by sharing research on emergency planning at conferences) to enable others to better understand what works and what does not in emergency situations.

Water sector guidance

Water infrastructure includes infrastructure for water supply, wastewater removal and treatment, stormwater management, as well as flood management and coastal protection. The water sector depends on energy, telecommunications and transport systems to operate, and in turn is key to the provision of social services.

Resilient water infrastructure provides appropriate levels of service, is multi-functional and interacts adaptively with external stakeholders and infrastructure.

This guidance is suggested for water asset owners and operators across all states and territories. However, it is acknowledged that parts of the sector in some states and territories may be more progressed than others, and consequently, the guidance may vary in its applicability in individual circumstances.

This section provides guidance that can be applied in the short term. *Advisory Paper 1: Opportunities for systemic change* can be used to determine the longer-term actions your organisation can take to support *infrastructure for resilience*.

Resilience category	Guidance
Infrastructure resilience	39. Consider whole-of-system approaches (for example, Integrated Water Cycle Management) during feasibility stages of project conception so that design solutions and operations contribute to resilience.
Community resilience	40. Engage stakeholders and user groups to identify and assess options for an Integrated Water Cycle Management approach.

Conclusion

Infrastructure Australia and Infrastructure NSW undertook the *Pathway to Infrastructure Resilience* research project based on a shared vision for a resilient future, where Australian communities can recover, transform and thrive in response to shocks and stresses, to realise positive economic, social and environmental outcomes.

This paper suggests practical and targeted guidance for asset owners and operators that can be implemented in the short term. In implementing these actions, asset owners and operators will be well on their way to achieving *infrastructure for resilience* for their assets, and for their region, state and the nation.

This paper provides only the priority actions asset owners and operators can implement as a starting point. To that end, asset owners and operators are encouraged to read the companion paper, *Advisory Paper 1: Opportunities for systemic change* which aims to build expertise, momentum for change and set a strategic direction for how we plan infrastructure to respond to these natural and non-natural threats over the longer-term.