

ATSE

SUBMISSION

Submission to The House of Representatives Standing Committee on
Regional Development, Infrastructure and Transport

Submission to the Road Resilience Inquiry

28 February 2023

The Australian Academy of Technological Sciences and Engineering (ATSE) is a Learned Academy of independent, non-political experts helping Australians understand and use technology to solve complex problems. Bringing together Australia's leading thinkers in applied science, technology and engineering, ATSE provides impartial, practical and evidence-based advice on how to achieve sustainable solutions and advance prosperity.

ATSE welcomes the opportunity to respond to the House of Representatives Standing Committee on Regional Development, Infrastructure and Transport's inquiry into the implications of severe weather events on the national regional, rural, and remote road network. ATSE makes the following recommendations to strengthen road network planning to mitigate these impacts:

Recommendation 1: Infrastructure planners need to ensure infrastructure decisions take a whole-of-systems approach in the planning phase.

Recommendation 2: The Australian Government must build data collection and sharing frameworks for infrastructure asset planning, design, construction, and maintenance to inform decision-makers.

Recommendation 3: Infrastructure planners need to enhance infrastructure assessment modelling by using probabilistic assessments to provide a more accurate and robust assessment of infrastructure asset performance.

Recommendation 4: The Australian Government must amend design and construction guidelines for road infrastructure that take into account up-to-date climate change metrics.

Recommendation 5: Infrastructure planners need to plan for the electrification of transport and ensure infrastructure assets like charging stations should be built to be resilient to external shocks caused by climate change.

Recommendation 6: The Australian Government must consult with Aboriginal and Torres Strait Islander communities and utilise Traditional Knowledge in developing measures to achieve road resilience.

Utilising a systems approach to create resilient road infrastructure

ATSE in its [Building a Resilient Australia Position Statement](#) outlined the importance of utilising a systems approach in the planning phase of infrastructure projects to achieve resilience. A systems approach takes advantage of the interconnected and interdependent relationships – including reinforcing and balancing feedback – among multiple infrastructure sectors (e.g. the close relationship of buildings, mobility and green spaces). Infrastructure assets and networks are linked inextricably with themselves, the community, and the natural environment. Adopting a systems approach allows for a more comprehensive and integrated approach to planning, design, construction and reduces the vulnerabilities of the road network and improves resilient to shocks and stresses.

This requires alignment, coordination and clear accountability across the various sectors, agencies and jurisdictions responsible for infrastructure planning, climate risk management, emergency management, community resilience and land use planning. This can be challenged by the fragmented, multi-level governance arrangements around resilience that currently exist in Australia in which actions to increase infrastructure resilience are not taken with a whole-of-system approach (Australian Academy of Technological Sciences & Engineering, 2022a). Planning for resilience is built on four pillars – economic, environmental, social and cultural – and their interdependent vulnerabilities. Utilising a systems approach would support infrastructure owners, designers and operators to make informed decisions regarding the likely impact and mitigation strategy for uncertain events, across the lifetime of the infrastructure asset. As part of the overarching goal of establishing sustainable infrastructure systems, a more comprehensive approach to infrastructure system adaptation is necessary. This approach generally has the most impact during the infrastructure system planning and design stages.

Recommendation 1: Infrastructure planners need to ensure infrastructure decisions take a whole-of-systems approach in the planning phase.

Collect and utilise data to model scenarios and inform decision-makers

The early adoption of meteorological reports and data allows weather and climate-related risks associated with a project to be understood and modelled, leading to huge potential cost savings across the whole project lifecycle.

ATSE's report, [Australia's Data-Enabled Research Future: Technology & Engineering](#), was part of a series of reports by the Australian Council of Learned Academies and Australia's five learned academies, in collaboration with the Australian Research Data Commons, that outlined the need for standardised, centralised, and transparent data to support infrastructure project planning and ongoing asset management.

Critical disaster and climate data (including data and information on shocks and stresses, the exposure of people and assets, and the vulnerability of people) are not coordinated and not standardised. Decision-makers need accurate, credible and timely data and guidance material to coordinate their actions and make informed decisions (Australian Academy of Technological Sciences & Engineering, 2022b). Sharing and standardising information on shocks and stresses, and applying nationally consistent data gathering and organising methods, would further improve road resiliency planning.

Recommendation 2: The Australian Government must build data collection and sharing frameworks for infrastructure asset planning, design, construction, and maintenance to inform decision-makers.

Incorporating probabilistic assessment to measure the resilience of road infrastructure projects

The development of a comprehensive risk-based approach to climate change resilience in road infrastructure will require the utilisation of available scientific climate projection data into engineering guidance and standards that practitioners can use when planning and designing future infrastructure projects. Extreme events can be random in nature. Resilience is most sensibly addressed by methods that consider the probability of their occurrence.

ATSE released an explainer on [probabilistic risk assessments](#), which is an evidence-based tool that supports infrastructure owners, designers and operators to make informed decisions regarding the likely impact and mitigation strategy for uncertain events, across the lifetime of the infrastructure. Utilising a probabilistic risk assessment would result in a more detailed description of variability in risk assessments which leads to better decision-making and systems design of infrastructure projects making them more resilient to extreme events (Australian Academy of Technological Sciences & Engineering, 2022c). ATSE supports continuous improvement in risk assessment modelling in line with the evolution of relevant technologies and evidence-based tools.

Recommendation 3: Infrastructure planners need to enhance infrastructure assessment modelling by using probabilistic assessments to provide a more accurate and robust assessment of infrastructure asset performance.

Updating standards for road infrastructure connectivity

An effective way to increase the resilience of road transport would be through identifying, developing or revising and subsequently implementing construction and design standards. This would also include research for new and innovative materials and techniques to build roads that are more resilient to withstand extreme weather. These activities should be incorporated into a standardised process aiming at increasing the overall resilience of the road network.

The selection of benchmarks in the current infrastructure design is based on the evaluation of historical trends and, consequently, the probability of specific design events. Accepted design principles and rules, such as the Australian Rainfall and Runoff and wind loading codes, provide examples. These guidelines and codes have identified events with statistical probabilities based on historical occurrences and they

examine how well a design performs in those events while taking appropriate safety factors into account (Connor et al., 2013). Climate change means that those same design parameters will experience a changed overall pattern. Therefore, it is imperative that governments at the state and federal levels work with research institutes and professional bodies that have been working in this area of adaptation, to create and implement a framework for design for a changing climate.

Recommendation 4: The Australian Government must amend design and construction guidelines for road infrastructure that take into account up-to-date climate change metrics.

Building resilience of public electric vehicle charging infrastructure

As Australia transitions away from traditional fossil fuel-powered vehicles and decarbonises transportation systems, resilient electrification infrastructure like charging stations as part of road networks will become vital assets. If chargers fail frequently or are unable to meet demand, that presents an inconvenience to current EV users and this will dissuade further uptake of EVs. To encourage greater EV adoption, charging infrastructure must be resistant to external shocks caused by weather, natural disasters, or technical faults). For example, in the case of flooding, there can be a disruption to the access of the charging infrastructure with chargers being out of service due to water damage or inaccessible due to water logging in the surrounding area. ATSE recommends that the Department utilises a system planning approach in the deployment of EV charging stations around Australia to ensure charging stations are resilient and reliable to external shocks caused by climate change.

Recommendation 5: Infrastructure planners need to plan for the electrification of transport and ensure infrastructure assets like charging stations should be built to be resilient to external shocks caused by climate change.

Utilising Aboriginal and Torres Strait Islander knowledge systems to achieve Road Resilience

Aboriginal and Torres Strait Islander people have been the traditional custodians caring for country, and have a unique relationship with the land and a deep understanding of the natural environment. Aboriginal and Torres Strait Islander communities may be able to provide infrastructure planners with guidance on areas that are prone to flooding, or those at risk of erosion. This would be essential information for infrastructure planners in identifying climate-resilient corridors for future road construction projects and measures to make existing infrastructure resilient to external shocks. Incorporating Traditional Knowledge should lead to more informed project decisions, implementation, and community support. ATSE advises that the Committee consults and engages with Aboriginal and Torres Strait Islander communities in the planning process, and utilises Traditional Knowledge to ensure road networks are better equipped to withstand the impacts of climate change.

Recommendation 6: The Australian Government must consult with Aboriginal and Torres Strait Islander communities and utilise Traditional Knowledge in developing measures to achieve road resilience.

References

- Australian Academy of Technological Sciences & Engineering. (2022a). *Australia's Data-Enabled Research Future: Technology & Engineering*. <https://www.atse.org.au/wp-content/uploads/2022/06/ARDC-interacademies-report-220623.pdf>
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- Connor, T., Niall, R., Cummings, P., & Papillo, M. (2013). Incorporating climate change adaptation into engineering design concepts and solutions. *Australian Journal of Structural Engineering*, 14(2). <https://doi.org/10.7158/S11-088.2013.14.2>