

NTRO

NATIONAL TRANSPORT
RESEARCH ORGANISATION

Submission

**Inquiry into the
implications of severe
weather events on the
national regional, rural,
and remote road network.**

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

February 2023



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1.0 Introduction

Thank you for the opportunity to make a submission to the House of Representatives Standing Committee on Regional Development, Infrastructure and Transport inquiry into the implications of severe weather events on the national, regional, rural, and remote road network.

Climate scientists are telling us we need to expect more extreme weather events more often in Australia. For our Australian road systems which are predominantly granular pavements with very thin bituminous surfacings there are direct and significant impacts of more extreme climate events. Our roads are highly susceptible to water inundation and moisture damage, this means a step change is required in the way in which we design, build, maintain and use the road system, a step change that reflects increased risk. A step change that has a focus on resilience and importantly, a step change that is sympathetic to the geographic, environmental, strategic, and fiscal challenges in an Australian context.

From low volume rural unsealed roads to high volume sealed strategic corridors, substantial resilience and efficiency gains can be achieved by reimagining how, and how often we measure our asset condition, moving towards predictive, proactive, and informed asset maintenance of the current network. The utilisation of appropriate materials and methodologies including recycled and innovative materials that improve water resistance enabling timely asset recovery as we build and maintain the existing and new road network.

We must also transfer the new knowledge developed in the delivery of new infrastructure to enable practitioners to adopt best practice so we can prevent a repeat of this infrastructure emergency conditions into the future.

For over 60 years the Australian Road Research Board (ARRB), that has now grown into the National Transport Research Organisation (NTRO for Road/Rail/Ports and Airports) has remained at the forefront of independent expert transport knowledge, advising key decision makers on our nation's most important challenges. We have earned a reputation for scientific integrity and are the leading providers of value-added applied research, technical services, and knowledge transfer across the length and breadth of Australia.

Service to our stakeholders (State and Territory Transport Agencies, Commonwealth Government and the ALGA) and the nation has been further enhanced by this transformation to the National Transport Research Organisation (NTRO). A truly, independent, multimodal transport organisation that is committed to continued scientific integrity, service and knowledge transfer across, ports, airports, rail and of course roads.

Your National Transport Research Organisation is here to assist and are delighted to be afforded the opportunity to provide a submission for your kind consideration.



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2.0 Measurement

The old adage that if don't measure it you can't manage it, is true for the road network we all use every day. Your NTRO collects the data for all State and Territory Transport Agencies on a regular basis and has step changed the data sets that are available to these transport agencies to better maintain their networks. The data that has been collected provides a deep understanding of:

Road strength

Road condition, cracking, rutting and profile

Full photogrammetry that is then analysed for lane widths and AusRAP/ANRAM safety assessments

Your NTRO is a global leader in the use of the world leading Intelligent Pavement Assessment Vehicle (iPAVE) technology which collects these data sets at 80kmph on our road system in a continuous and seamless fashion.

There are a number of innovative, products, recycled materials and methodologies that will achieve greater network resilience however, we must first understand our asset condition and impacting environmental conditions to ascertain the correct solution for the problem at hand.

Recommendations:

- 2.1** Undertake a State-wide Asset Condition Assessment of the entire road network utilising Intelligent Pavement Assessment Vehicles (iPAVE) or similar technologies that can assess ride quality, deflection, roughness, texture, rutting, digital imagery for visual rating and ACD cracking at traffic speed in a single pass.
- 2.2** As road safety is also compromised by severe weather impacts, and technologies such as (iPAVE) can also collect safety data it would be prudent to incorporate a network safety assessment as an integral part of a network Road Asset Condition Assessment.
- 2.3** Enable proactive and strategic planning - Provide Local Government Road Condition Assessment incorporating asset condition measurement and driving resilience outcomes.
- 2.4** Provide support to collaborative organisations of councils (neighbouring Local Government Groups) to maximise measurement efficiencies whilst reducing establishment costs.
- 2.5** Knowledge Transfer - Engage your National Transport Research Organisation (NTRO) to expand the Local Government Best Practice Guides to incorporate Asset Measurement and Resilience.

A step change and focus on condition assessment frequency and the technologies utilised should form the backbone of our strive for greater asset resilience. A resilience that should start at a holistic network level and then translated for use by practitioners at a project level.

Using NTRO technology, we can measure ride quality and road conditions. The NTRO has a suite of state-of-the-art vehicles fitted with lasers and high-tech equipment that measure road conditions at traffic speed, and they help us to find issues with a road before they become apparent to the naked eye. Our Intelligent Pavement Assessment Vehicle (iPAVE) has lasers and other high-tech equipment and can measure road condition at traffic speed as well as smaller survey vehicles which can be used on unsealed regional roads. These vehicles have recently been equipped to service local government roads that connect communities and connect farm gate to highway or rail head.



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The accuracy and resolution of the iPAVE helps engineers to pinpoint areas where the pavement is subject to failure, allowing councils and road agencies to decide where best to spend their valuable maintenance dollars. The benefits of knowing the right time, right place and right treatment are delivering BCR's for State Agencies in excess of 10.

With 80% of our road network being the responsibility of Local Government we must help to overcome funding challenges where Local Government often have to make the difficult choice between undertaking appropriate asset condition assessments, solution identification and applying best practice methodologies or just getting the job done that their field supervisors identify.

Figure 1 – Intelligent Pavement Assessment Vehicle (iPAVE)





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3.0 Maintenance

We need to expect more extreme weather events more often in Australia. For our roads, this means the maintenance schedules need to be modified to reflect the increased risk. It also means the standards that we use for the construction of our road systems need to change to have a resilient focus.

Right now, we are doing the same level of maintenance for the network that we have always undertaken, when we should be building and maintaining our roads for what we can expect in the future. Your NTRO are here to assist in delivering resilient solutions that also deliver safer roads for all users.

Recommendations:

- 3.1 Provide support to Local Government to transition from scheduled forms of maintenance to predictive, through an in-depth understanding of asset condition (see section 2.0 Measurement), rendering significant fiscal savings across the life of the asset and enhanced performance outcomes.
- 3.2 Encourage maintenance frequency, repair, and mitigation through the application of minimum longevity expectations for remediation solutions.
- 3.3 Encourage alternative treatment options that preserve and protect rather than patch and replace.
- 3.4 Encourage the application of Assurance Systems over Asset Management Practices to 'assure' required performance outcomes.
- 3.5 Knowledge Transfer - Engage your National Transport Research Organisation (NTRO) to expand the Local Government Best Practice Guides to incorporate Asset Maintenance and Resilience.
- 3.6 Provide funding assistance to Local Governments in Maintenance Best Practices to bridge the current knowledge gap.
- 3.7 Review and amend standards to incorporate innovative materials, recycled materials and methodologies that enhance the resilience of the asset.

It could be argued that too often maintenance is undertaken with a view to expediency rather than best practice or resilience. It would seem prudent that minimum performance outcomes be rigorously applied to even minor pavement repairs to avoid rapid deterioration towards a major repair and the associated increased fiscal burden, reduced ride quality and safety.

Flowing from the collection of a comprehensive data set on road condition are the maintenance strategies that can be developed to meet the challenges that the condition of the network exposes. A new regime of predictive maintenance to deal with the rapidly evolving set of environmental conditions that are being experienced on the network is now required.

More resilient solutions

Better use of local materials and marginal materials that are fit for purpose

More frequent and more skilled intervention

Different treatment options that preserve and protect rather than patch and replace



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4.0 Materials

We enjoy some of the smartest road technology and materials science in the world right here in Australia. Our extensive research confirms that many recyclables – including tyre rubber – are not only eco-friendly but will create more durable and resilient road surfaces. By using appropriate recycled materials that have better resistance to cracking hence reduce the incidence of moisture ingress in roads, we can ensure that fewer potholes and road failures occur.

This will also improve the durability of our roads and reduce the materials we send to landfill which will result in much better environmental outcomes. ARRB/NTRO recently released a major report which provides an independent, expert review on how to sustainably and successfully increase the use of recycled materials in road and rail infrastructure whilst improving resilience.

Recommendations:

- 4.1** Incentivise the introduction of mobile mix/processing plant availability to the regions to overcome the tyranny of distance and expand serviceability area of recycled materials. (eg Crumb Rubber, crushed glass)
- 4.2** Improved awareness and education of how materials are used, supported by policy and procurement drivers, new and improved specifications and more modern recycling facilities with increased capacity.
- 4.3** Knowledge Transfer - Engage your National Transport Research Organisation (NTRO) to expand the Local Government Best Practice Guides to incorporate Resilience and Recycled Materials.
- 4.4** Support Local Governments through training/advisory programs in the application of materials including recycled to improve adoption, resilience and promote best practice and performance outcomes.

It is imperative that our roads do not become the dumping ground for inappropriate waste material, helping to assuage environmental consciousness but degrading asset performance outcomes. Your NTRO has undertaken extensive research that has identified a number of recycled materials and treatments that when combined with or replacing conventional materials at optimal ratios, not only provide environmental benefit but also enhanced performance, sustainability and resilience outcomes.

The next generation of materials available for the road sector are already here. Delivering higher levels of resilience and better protection from the threats of the environmental extremes and vehicle use.

A report released by ARRB/NTRO (Part A: Technical Review and Assessment) is the first of two Best Practice Expert Advice on the Use of Recycled Materials in Road and Rail Infrastructure reports completed for the Commonwealth Government. Combined, these reports support the Australian Government's delivery of the National Waste Policy Action Plan 2019 objective to increase the use of recycled content in road and rail infrastructure and inform government procurement requirements.

This report provides a review of government policies and actions that support the transition to a circular economy through the use of recycled materials in road and rail infrastructure. It also provides a technical examination of the application and uses of recycled materials; emerging opportunities; comparative performance to virgin materials; market maturity; supply; and estimated recycled content potential.



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Part B provides further information on the environmental, economic and social impacts of using recycled materials in major infrastructure projects across the road and rail industries in Australia.

Key Findings (report extracts)

Australian governments have introduced a range of policies, strategies and plans to promote the reduction of waste, recycling and reuse of materials and drive the transition towards a circular economy.

The National Waste Policy: Less waste, more resources 2018 provides the national framework for waste and resource recovery in Australia and has been endorsed by all levels of government. While the details of policies and plans vary from jurisdiction to jurisdiction, all are working towards the targets in the National Waste Policy Action Plan. This includes reducing total waste generated and an 80% average resource recovery rate from all waste streams.

Most state and territory policies and targets aim to turn Australia's major waste streams into valuable commodities, driving both the demand and supply of recycled materials and creating new market opportunities. This transformation will generate long-term economic benefits, lower carbon emissions, and help deliver a circular economy. There are, however, few specific quantifiable targets to significantly increase the use of recycled content by governments and industry, as set out in the national policy.

As purchasers and managers of major road and rail infrastructure, governments drive market demand through their purchasing decisions. The Australian Government, as well as all states and territories have some form of procurement guidance that, at a minimum, supports value-for-money purchasing that delivers on environmental, social and economic goals. Most jurisdictions have a sustainable or green procurement policy or guidance that refers to purchasing considerations around the desirability of using recycled materials, recyclability and reuse of purchased products together with waste reduction.

The Commonwealth's Sustainable Procurement Guide recommends setting mandatory, minimum or desirable requirements for use of recycled materials when planning a project. Only Victoria and South Australia have explicit guidance around establishing these. Other jurisdictions' guidance around recycled materials is presented as desirable procurement outcomes.

Industry, local and state governments have been gradually increasing their use of recycled material in road and rail infrastructure projects, and there is a keen interest across industry and government to improve sustainability outcomes. Industry confidence varies according to the extent the use of a material has been established. For example, there is lower confidence in newer and emerging applications, such as recycled plastics in pavements and rail sleepers. Conversely, there is higher confidence in the use of crumb rubber in sprayed seals, based on decades of use nationally.

Some of the key barriers to the growing use of recycled materials in infrastructure include a lack of awareness and education; a disconnection between market demand and supply; a lack of more enabling specifications, standards and guidelines; and lastly, a lack of evidence to guide long-term performance outcomes and sustainability benefits.



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The Materials

In terms of performance, cost and sustainability impact, the following high-level findings can be inferred from the research undertaken:

- *Crushed Concrete and Brick: the use of crushed concrete and brick as a supplementary material for virgin crushed rock is a well-established practice. Certain applications can enable use of up to 100% recycled crushed concrete, dependent on material properties and performance requirements. It is estimated that 8,000 tonnes of construction and demolition waste would be diverted from landfill per kilometre of road construction.*
- *Recycled Crushed Glass (RCG): recycled crushed glass can be employed in the construction of embankments, structural and non-structural fill, retaining wall backfill and drainage, with several specifications in place to support its use. The use of glass in road pavements and as a replacement for virgin sand in some rail applications are several of the emerging opportunities.*
- *Reclaimed Asphalt Pavement (RAP): reclaimed asphalt pavement, once milled from end-of-life pavements, can be recycled into new pavements or utilised as a granular material for unbound granular pavement. Up to 100% RAP can be used or supported through the incorporation of rejuvenators. The use of RAP is widely accepted across Australia, with several standards, guidelines and specifications outlining requirements for successful and beneficial use. This results in an efficient and cost-effective use of resources.*
- *Crumb Rubber: crumb rubber has been used in sprayed seal applications for decades, in small volumes. Additionally, there are several applications in asphalt pavements, with a variety of standards and specifications developed nationwide. Less prominent applications include the potential for use in rail ballast, or as tyre-derived aggregates. Performance-wise, crumb rubber has been found to positively affect pavements, including through reduced noise and risk of cracking. Crumb rubber is a relatively mature market, with over 20 recyclers and over 1,500 accredited retailers, and there is sufficient supply of end-of-life tyres to support more use of the material in road and rail.*
- *Ground Granulated Blast Furnace Slag (GGBFS): GGBFS is typically used as a supplementary cementitious material or as a Portland cement replacement, offering a durability and strength increase compared to using Portland cement. This application is relatively mature, emerging in the 1960s. There is only one operational producer of the material in Australia, with some supplies imported.*
- *Fly Ash: some applications include fly ash as a supplementary cementitious material, a Portland cement replacement, or a filler in asphalt, with strong comparable performance to non-recycled materials. Several standards and specifications are in place for fly ash use across Australia. Recovery rates for generated fly ash are variable, with WA at 72% compared to Qld at 18% and NSW at 10%.*
- *Bottom Ash: bottom ash, a by-product from coal combustion or Waste to Energy plants, can be employed as a bound or unbound aggregate. Bottom ash from Waste to Energy plants is confidently used by industry globally, predominantly in Europe. There is no current market in Australia but given Waste to Energy is an emerging waste management practice in Australia and the abundance of coal-based plants, the material has potential to be commercially available in the near future.*



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- *Solid Organics: solid organics, sourced from plant or animal waste, may be used in several applications within the transport industry, predominantly landscaping; erosion control; and bioorientation and biofiltration. Around 50% of solid organic waste presently enters landfill, with large stockpiles nationwide, indicating a real potential for the material to be recycled into higher value uses.*
- *Ballast: in-situ cleaning of rail ballast is a current practice across Australia and there is potential to increase the practice. Additionally, removal and ex-situ cleaning of ballast is an emerging practice with keen industry interest, however very few facilities possess the right processing capacity.*
- *Recycled Plastics: recycled plastics have the potential to be employed in a number of road and rail applications, including in asphalt, railway sleepers, pipes, bollards, supplementary aggregate material, noise walls and bike paths. Australia's recovery rate of recycled plastics is around 10%, indicating a significant available supply, yet the market maturity of recycled plastics applications in infrastructure is relatively low. Notably, however, there are many emerging initiatives to increase recycling programs nationally. Key challenges include environmental factors such as risk of microplastics and leachates, as well as validating performance to increase industry confidence.*

Although the report is believed to be correct at the time of publication, the Australian Road Research Board, to the extent lawful, excludes all liability for loss (whether arising under contract, tort, statute or otherwise) arising from the contents of the report or from its use. Where such liability cannot be excluded, it is reduced to the full extent lawful. Without limiting the foregoing, people should apply their own skill and judgement when using the information contained in the report.

Executive Summary Conclusion

This report shows that there are a lot of recycled materials that are widely used and that there is ample opportunity to increase their percentages within applications, or even the frequency that they are used, within their most suited application. There are also emerging recycled materials technologies that have significant opportunity for increased uptake. Improved awareness and education in how these materials are used, supported by policy and procurement drivers, new and improved specifications and more modern recycling facilities with increased capacity, can all contribute to increases in the use of recycled materials, resilience and sustainability outcomes and a more circular economy.

To encourage the uptake of resilience building practices in rural and regional areas we must overcome the tyranny of distance, material affordability and availability.

It is important to note that the "pavement" can be viewed as an engineered interface to a larger natural structure. If failures from severe weather are impacting the larger formation the pavement can fail irrespective of high standard of design and construction. We must understand the condition of our assets and contributing factors in the first instance.



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5.0 Methodology

To achieve greater asset resilience we believe that a step change is required to our approach to standards, specifications, profiles, materials and practices with a strong focus on drainage and mitigating moisture ingress.

We must also transfer the new knowledge developed in the delivery of new infrastructure to enable practitioners to adopt best practice so we can prevent a repeat of this infrastructure emergency conditions into the future.

At its core we must develop and apply fit for purpose, value for money solutions that reflect the condition of the network and meet the functional requirements needed by the community. Not only delivering greater resilience but improving road safety, journey quality, asset life fiscal efficiency and circular economy outcomes.

Recommendations:

- 5.1 Adopt a review of existing pavement profiles and drainage towards more resilient architecture and performance outcomes.
- 5.2 Address the disproportionate burdens towards best practice adoption faced by regional, rural and remote communities.
- 5.3 Undertake a review and adoption of standards and specification of materials and construction best practices with a focus on not only resilience but also road safety, journey quality, fiscal efficiency and importantly, practicality.
- 5.4 Adopt Assurance Systems to augment road design and construction activities to assure required performance outcomes.
- 5.5 Incentivise the proliferation of innovative assessment tools such as your NTRO developed NetRisk 2.0, ROAM, InfraCalc, National Road Crash Database etc. to assist State and Local Governments and practitioners to identify optimal solutions.
- 5.6 Knowledge Transfer - Engage your National Transport Research Organisation (NTRO) to expand the Local Government Best Practice Guides to incorporate Resilient approaches to Road asset construction and maintenance practices.
- 5.7 Address capability shortage through seamless recognition of National Skills Certification and the reflection of these core competencies in tender and contract documents.
- 5.8 Adopt a National TYPES/CERTIFICATION approval process for the assessment and recognition of new and innovative materials, processes and products. Your NTRO are proud to be an active participant in the reimagining process supported by TfNSW.
- 5.9 Support Local Governments through training/advisory programs in the application of materials including recycled to improve adoption, resilience and promote best practice methodologies and performance outcomes.