WARRIP
WESTERN AUSTRALIAN ROAD RESEARCH & INNOVATION PROGRAM

WARRIP 2023-25

PROGRAM HIGHLIGHTS

TO FIND OUT MORE
GO TO WARRIP.COM.AU OR
EMAIL INFO@WARRIP.COM.AU

A JOINT INITIATIVE BETWEEN

ABOUT THE PROGRAM

THE WESTERN AUSTRALIAN ROAD RESEARCH AND INNOVATION PROGRAM (WARRIP) IS A JOINT INITIATIVE BETWEEN MAIN ROADS WESTERN AUSTRALIA AND THE NATIONAL TRANSPORT RESEARCH ORGANISATION (NTRO). OUR MISSION IS TO POSITIVELY CONTRIBUTE TO THE DESIGN, CONSTRUCTION AND MAINTENANCE OF TRANSPORT INFRASTRUCTURE IN WA, THROUGH THE DELIVERY OF PERTINENT, COLLABORATIVE RESEARCH.

Innovation

Be curious. Contribute to the body of knowledge.

Collaboration

Share our learnings with industry, government and academia.

VISION

To be a leading voice enabling the development of sustainable solutions for a safer transport sector.

Sustainability

Advocate for a better future. Seek value in all endeavours.

Implementation

Support and champion the uptake of good ideas.

Quality

Strive for excellence in all that we do.

A JOINT INITIATIVE BETWEEN

MEET THE BOARD

John Erceg

MANAGING DIRECTOR, MAIN ROADS WESTERN AUSTRALIA

Doug Morgan

EXECUTIVE DIRECTOR PLANNING AND TECHNICAL SERVICES, MAIN ROADS WESTERN AUSTRALIA

Michael Caltabiano

CHIEF EXECUTIVE OFFICER, ARRB

Richard Yeo

CHIEF OPERATIONS OFFICER, ARRB

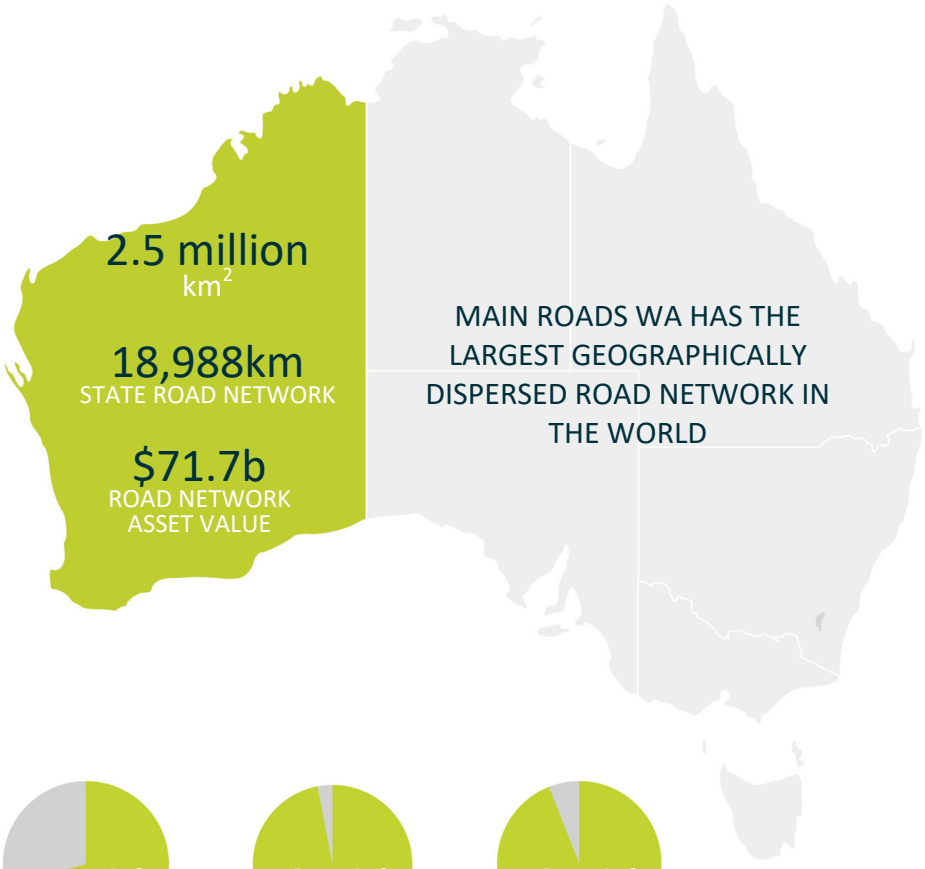
PROGRAM SNAPSHOT

AS OF 2025, THE WARRIP'S RESEARCH OUTCOMES HAVE RETURNED AN ESTIMATED DIRECT AGENCY BENEFIT COST SAVING OF BETWEEN $90.1 AND $209 MILLION AGAINST PROGRAM COSTS TOTALLING $18 MILLION.

67
RESEARCH TOPICS INVESTIGATED

117
TOTAL PROJECTS

85
PROJECTS COMPLETED



MAIN ROADS WA HAS THE LARGEST GEOGRAPHICALLY DISPERSED ROAD NETWORK IN THE WORLD

4 INDUSTRY PARTNERSHIPS

3 JOINT RESEARCH PROJECTS

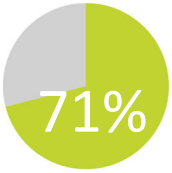
4 UNIVERSITY COLLABORATIONS

10
YEARS ACTIVE

1,035
MILESTONES DELIVERED

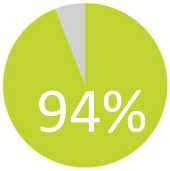
>4.5
ACHIEVED BCR (2021-2023)

90
REPORTS PUBLISHED



ON TIME

ON BUDGET



TO REQUIRED QUALITY

RESEARCH OUTCOMES

THE WARRIP CAN MEASURE ITS SUCCESSES NOT ON THE STATISTICS OF ACHIEVEMENTS AS CONTAINED HERE-AFTER, BUT ON ITS ABILITY TO DISSEMINATE THE FINDINGS FOR EASE OF ADOPTION AND IMPLEMENTATION.

SUSTAINABILITY

Producing sustainable outcomes is a key driver for the WARRIP. Research topics include using recycled materials, assessing the sustainability of pavement designs and evaluating design decisions that can reduce emissions.

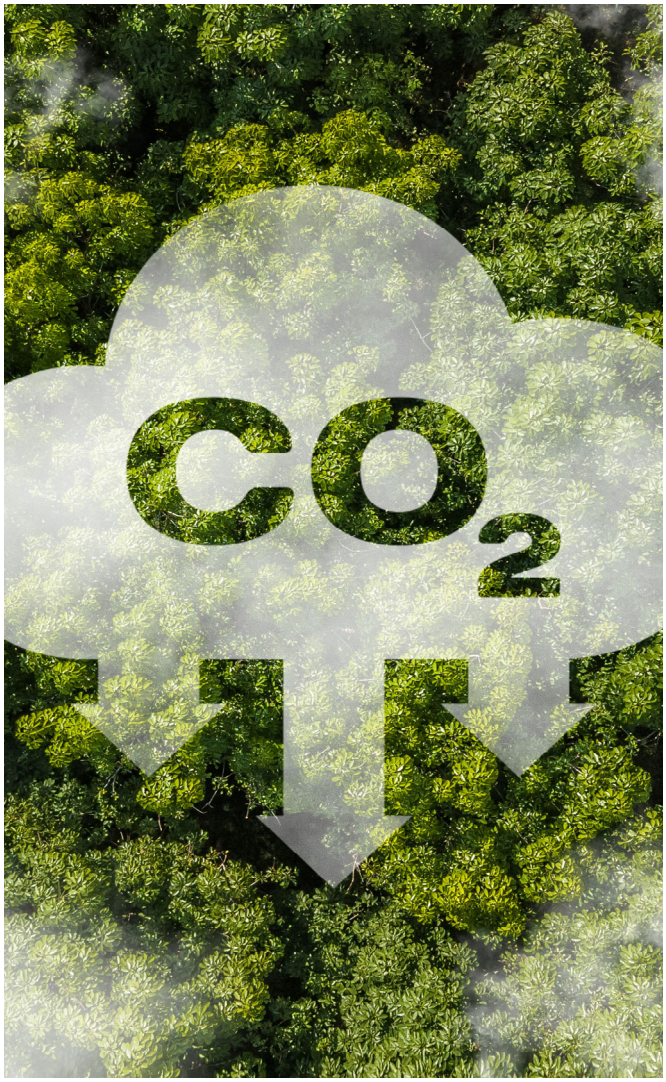
Recycled and Sustainable Materials at Main Roads WA

WARRIP has conducted a comprehensive review of Main Roads WA's current use of recycled materials in transport infrastructure, which focused on quantities, availability and limitations. This research identified the most beneficial applications of recycled materials and updated existing guidance documents. As a result, updates to the *Recycled and Sustainable Materials Guide* were developed. This guide is intended to support future projects in effectively incorporating recycled materials, thereby promoting sustainability and resource efficiency in Western Australia's transport infrastructure.

Sustainability Assessment Tool for Pavements (SAT4P)

In a joint initiative with the National Asset Centre of Excellence (NACOE), WARRIP has developed a web‐based tool for comparing potential pavement designs based on their whole-of-life environmental and economic impacts. SAT4P enables consistent and reliable comparisons of pavement options by assessing factors such as design, material and product selection, maintenance regimes, and end-of-life considerations. The tool addresses the limitations of existing assessment methods by accommodating innovative materials and technologies, including recycled materials and warm-mix asphalt. By aligning with the Infrastructure Sustainability Council's (ISC's) rating processes, SAT4P supports informed decision-making that advances sustainability objectives, such as greenhouse gas emissions reduction and circular economy targets, within Western Australia's road infrastructure projects.

The SAT4P has advanced significantly over the past year, with updates to its web platform, reference data, library of products used and guidance materials. WARRIP will continue to maintain this useful tool by encouraging projects to consider more sustainable options when designing pavements.



Emissions reduction opportunities

Decarbonisation is the process of reducing carbon dioxide (CO2) and other greenhouse gas emissions. It requires a shift from processes that rely on fossil fuels to processes that use renewable energy sources. WARRIP is undertaking a comprehensive review of emissions reduction initiatives implemented across Western Australia's road and transport projects. This research involves collecting data on completed projects to identify specific strategies that have contributed to lowering emissions. The effectiveness of these decarbonisation initiatives is being evaluated, and case studies will document the challenges encountered and overall impact of the projects. This will provide actionable insights and practical examples that can inform and guide future projects, supporting the state's broader commitment to achieving net zero emissions by 2050.

WARRIP PROJECT

NETWORK GENERATION OPERATIONS: ASSET MAINTENANCE EFFICIENCY

TECHNICAL AREA: ASSET MANAGEMENT

YEARS: 2022 to present

WARRIP began investigating the processes used by Main Roads WA for inspecting, reporting, planning and repairing common defects often found on highly trafficked road networks. Identifying ways to improve the process will allow for a greater use of maintenance funding to repair and improve the Western Australian road network.

The project reviewed Main Roads WA's documentation and compared it with other Australian state road agencies to analyse trends and explore more efficient processes and technologies. This involved running numerous workshops with each region's staff to identify the various problems and opportunities in routine maintenance practices. Comments that were received during the workshops were used to develop the project, and many were refined into recommendations as well.

The project team identified the potential value in considering an upgrade to the tablets and software currently used for field data collection, as well as exploring ways to resolve photo resolution issues that can affect data quality. Enhancing regional communications could also be beneficial. It might be helpful to review and refine defects definitions to ensure a consistent approach, including how priorities and risks are assessed, and to consider developing a visual field guide while reducing subjective terminology. Supporting the development of coordinated cross-organisational user groups may improve collaboration across various functional areas. Additionally, reassessing how major incidents are managed could lead to more effective responses. There may be opportunities to improve the processes for reporting defects and determining their priority, and to establish a verification process for inspections to better manage resources and maintain work quality. Exploring options for tracking costs related to special events within the maintenance management information system could also be worthwhile. Finally, it might be useful to look into creating a trial process for defective detection technologies.

ASSET MANAGEMENT

WARRIP continues to advance asset management practices for Western Australia's road and transport infrastructure through a range of targeted research initiatives. A key area of new research is the development of a Pavement Residual Risk Framework – a data-driven methodology designed to support Main Roads WA in adopting a comprehensive, risk-based approach to asset management. This framework will enable more informed decision-making around funding allocation by assessing the residual risk of pavement assets and identifying where investment will deliver the greatest preservation and sustainability benefits over the long term.

In the structures space, research into epoxy timber pile repair methods has progressed, with laboratory testing now underway to evaluate the mechanical properties of epoxy-treated timber. Previous stages investigated the products available and developed a draft technical specification for on-site rehabilitation. Further work will include testing Jarrah timber as a representation of Western Australian structural timbers. This testing will produce conservative results as the other commonly used timber, Karri, is stronger and stiffer than Jarrah. Both shear testing and bending tests will be conducted through this project, with detailed sample preparation and test methods outlined. Recovered timber piles have been located and the condition of these piles assessed for use within this testing program. Initial results are promising. If successful, this treatment could provide a cost-effective way to extend the service life of timber bridges.

ROAD SAFETY

Research plays a critical role in improving road safety by identifying effective strategies, informing policy and guiding investment in treatments that reduce crashes and save lives.

WARRIP continues to support improvements in road safety through targeted research and assessment initiatives. The Australian Road Assessment Program (AusRAP) collects data about a road's attributes and usage to calculate a road safety star rating. The higher the rating, the safer the road. A review of Main Roads WA's AusRAP star rating coding has been undertaken to evaluate the effectiveness of using the Australian Integrated Road Assessment Program (AiRAP) processes in generating reliable star ratings. AiRAP uses a wide range of data sources, such as light detection and ranging (LiDAR), video and satellite imagery. This work aimed to enhance the efficiency and accuracy of network-wide road safety assessments by leveraging technology and datasets that are already available.

In parallel, WARRIP is assessing the performance of previously implemented low-cost urban road safety treatments by analysing crash data and site conditions to determine treatment effectiveness and ensure value for money. The findings will support evidence-based investment in safety treatments that deliver measurable outcomes across urban networks.

INNOVATION AND EMERGING TECHNOLOGIES

WARRIP is on the forefront of investigating emerging tools and technologies that could improve efficiency, reliability and safety of the Western Australian road network. The following are innovative ideas that WARRIP is currently investigating for their potential application in our network.

WARRIP is aiming to develop a new freeway weaving capacity analysis methodology based on the Maximum Sustainable Flow Rate (MSFR) approach. This research, which is already underway, addresses a key gap in current freeway modelling, where existing methodologies do not adequately estimate the impact of weaving movements. MSFR-based methodologies for weaving, merge and diverge are the missing links in our freeway modelling and will provide a more accurate and robust framework for assessing capacity constraints caused by vehicle weaving. This will ensure that freeway planning and design better reflects real-world traffic behaviour. The outcome will support more effective infrastructure design – avoiding both under- and over-dimensioning – and will be applicable across Western Australia and other jurisdictions nationally.

This is our first traffic operations project, which is a new area of research for WARRIP as we constantly evolve to meet the needs of Western Australia.

Another area of research is in understanding the potential to use ground penetrating radar (GPR), a non-destructive method for assessing pavement that can also be undertaken at traffic speeds. With WARRIP's initial research on the application of this technology showing promising savings, the program aims to undertake field trials to further our understanding of this technology. WARRIP's previous research assessed the application of GPR during road construction and maintenance and highlighted the potential cost savings this may generate, by reducing the need for traffic management and lane closures.

WARRIP PROJECT

INFRASTRUCTURE VULNERABILITY DUE TO CLIMATE CHANGE

TECHNICAL AREA: SUSTAINABILITY

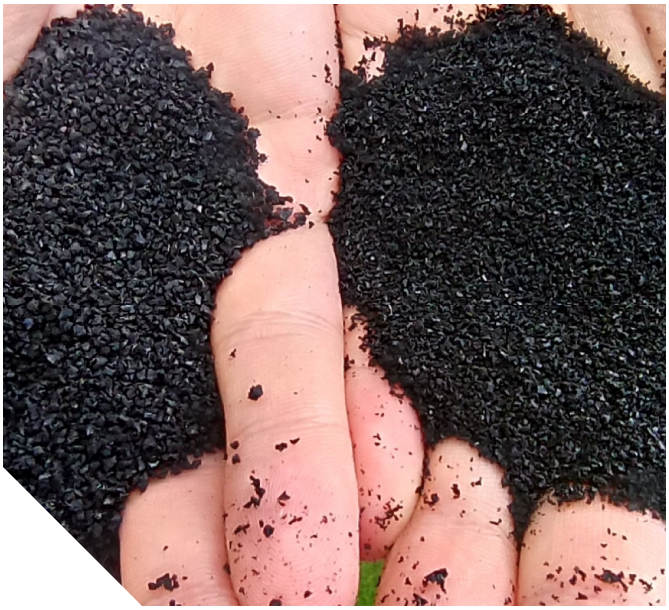
YEARS: 2021 to 2024

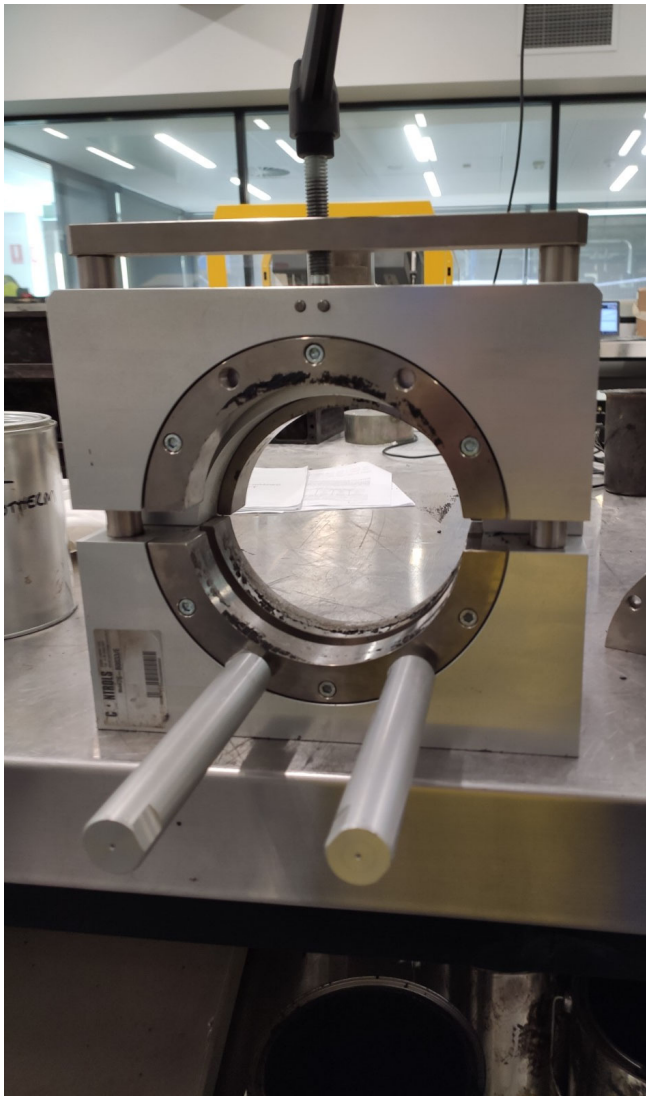
With the increase of extreme climatic and weather events, the potential social, environmental and economic risks of a vulnerable road network increase. To proactively identify and mitigate the risk of climate change on our road network, this project developed a framework for assessing vulnerabilities on the road network using climate data and projections. The framework will be used to inform decision-making of Main Roads WA asset managers to improve the resilience of the Western Australian road network, leading to fewer disruptions, reduced maintenance costs and improved safety for road users.

To develop a comprehensive register of strategic links in all Western Australian regions, this project identified the key elements to create a risk register based on road and climate data and then refined this risk register through consultation with key local stakeholders. A risk-based visualisation of the strategic links captured the link-level connectivity, redundancy, asset condition, historic climate and climate projection risk of all the links. This assessment provided insights into the level of vulnerability of the road network to climate risks across Western Australia. These insights can be used to prioritise further investigations and investments into the adaptive measures that can be taken to improve these scores and reduce the impacts of climate change on the state network.

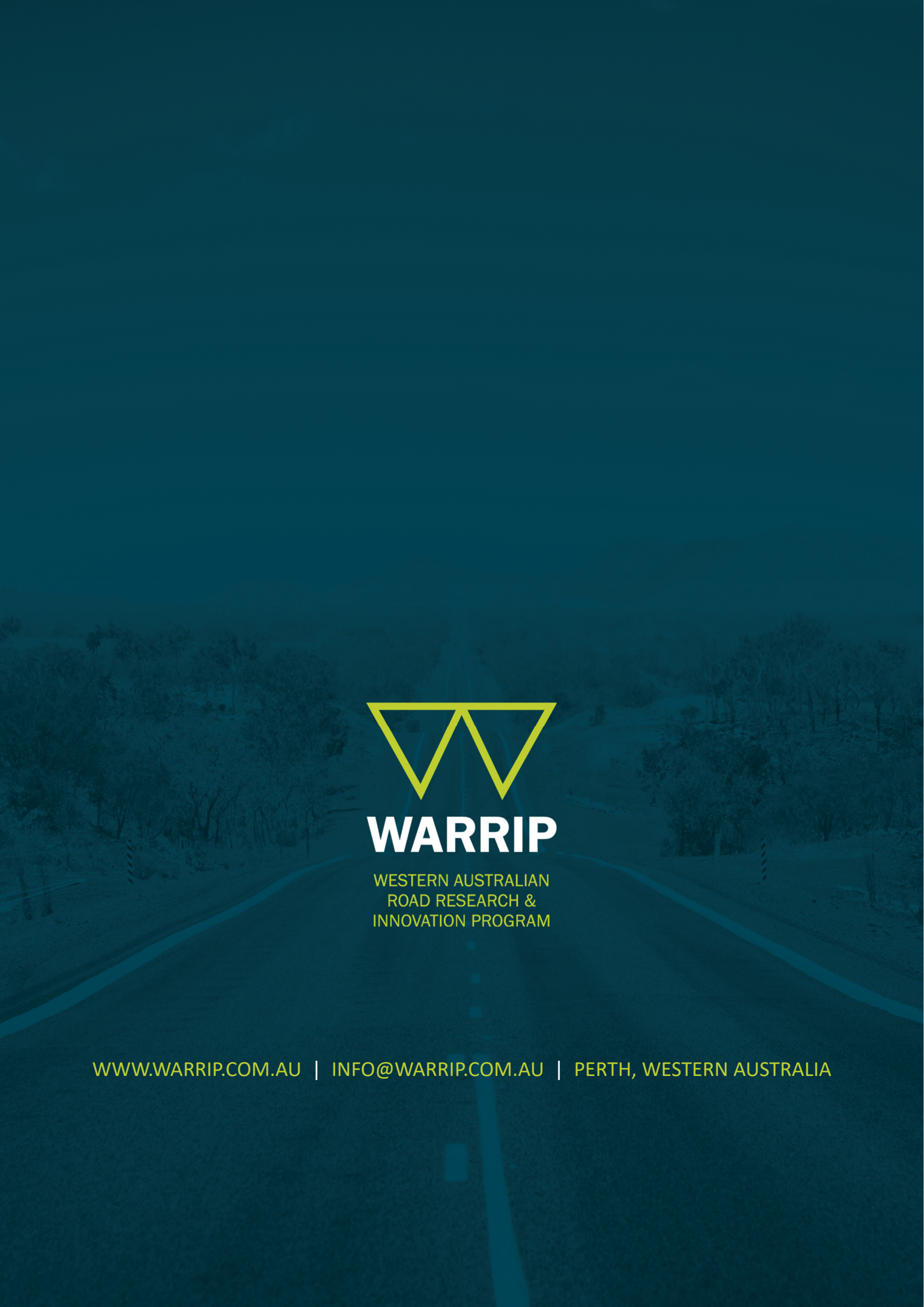
PAVEMENTS

Crumb rubber from recycled tyres and conveyor belts has now become common practice, especially since this material, when added to a binder, enhances the properties of the binder. Incorporating crumb rubber modified bitumen (CRMB) into pavements on the Western Australian network aims to improve pavement performance and contribute to a circular economy. To better understand the impact of the variables in procuring and applying CRMB on Western Australian roads, WARRIP has been undertaking further testing on the interaction between bitumen and various crumb rubber types. The impacts of different mixing temperatures, sources of crumb rubber and size of the crumb rubber particles are not yet fully understood. By employing an extensive laboratory testing program, WARRIP has investigated numerous combinations of CRMB, measuring and comparing the properties and performance of the mixes. This enhanced understanding of the variables involved in CRMB production will allow for wider application of CRMB in the Western Australian network as Main Roads WA will better understand the optimal rubber digestion times that maximise the properties of the rubber.





Another area of pavement research is the investigation into the application of bond coats in Western Australia and the possible implementation of the Leutner Test. Due to a variety of factors in the application process, debonding and delamination can occur in a pavement which lead to its failure. Internationally, the application of bond coats and trackless tack coats has demonstrated significant reductions in these risks and has improved the longevity of asphalt pavements. Researching bond coat technology and the Leutner Test Method will enhance our ability to determine which situations are best suited for using bond coats and how best to apply them under the specific project's circumstances. This research can greatly impact the performance of our roads and help reduce the cost of road maintenance.



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