NACOE

ANNUAL HIGHLIGHTS REPORT

2024-2025

AN INITIATIVE BETWEEN

Queensland Government | NTRO NATIONAL TRANSPORT RESEARCH ORGANISATION

Acknowledgment

We want to acknowledge our partners, the Queensland Department of Transport and Main Roads (TMR) and the National Transport Research Organisation (NTRO), formerly the Australian Road Research Board (ARRB), for developing the NACOE Program over the past ten years.

We also thank and acknowledge the organisations, universities, delivery partners, and industry associations collaborating on NACOE projects. Their valued support and input make much of our road research work possible.

Additionally, NACOE recognises its valued research partners:
Australian Flexible Pavement Association (AfPA), The Western Australian Road Research Innovation Program (WARRIP), Austroads, Brisbane City Council, Tyre Stewardship Australia, Gold Coast City Council, University of the Sunshine Coast (UniSC), Central Queensland University (CQU), The University of Queensland (UoQ), Queensland Government Department of Environment, Science and Innovation (DESI), University of Southern Queensland (UniSQ), Queensland University of Technology (QUT).

About our Partners:

The Queensland Department of Transport and Main Roads (TMR) and the National Transport Research Organisation (NTRO) are partners in initiating and supporting the NACOE program.

Queensland Government

Queensland Department of Transport and Main Roads (TMR)

The Department of Transport and Main Roads (TMR) moves and connects people, places, goods, and services safely, efficiently, and effectively across Queensland. It plans, manages, and delivers Queensland's integrated transport environment for sustainable road, rail, air, and sea transport solutions. TMR's vision is to create a single integrated transport network that is accessible to everyone. The integrated transport planning approach ensures that TMR contributes to people's quality of life, Queensland's economic well-being, and a sustainable environment.

NTRO NATIONAL TRANSPORT RESEARCH ORGANISATION

National Transport Research Organisation (NTRO)

NTRO is the independent expert transport knowledge body for Australia and New Zealand, trusted by government and industry to address the nation’s most pressing mobility challenges. Evolving from its roads-based heritage as the former Australian Road Research Board (ARRB), NTRO now supports all transport modes — road, rail, ports and airports — helping agencies navigate the shift toward integrated, future-focused mobility. Through strong partnerships and global collaboration, NTRO delivers reliable, evidence-based solutions that make transport networks safer, smarter, and more efficient for the communities they serve.

NACOE 2024 – 2025 RESEARCH PROGRAM

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FOREWORD BY THE BOARD

I am pleased to present the National Asset Centre of Excellence (NACOE) 2024–25 Annual Highlights Report, which demonstrates the program's ongoing contribution to a safe, reliable, sustainable and efficient transport network for Queensland.

Over the past year, NACOE research has delivered practical outcomes that extend network longevity, advance sustainable solutions and strengthen collaboration across jurisdictions and sectors for the benefit of Queensland's road network.

NACOE's collaborative model remains fundamental to its success. In partnership with Main Roads Western Australia and the National Transport Research Organisation, NACOE received the International Road Federation Emergency and Disaster Response Management Award in Athens for developing a framework to embed bushfire considerations into transport infrastructure design.

Our work with industry and leading universities also advanced testing methods for geosynthetic reinforced pavements, improving performance while reducing construction costs and carbon emissions.

Safety and reliability remain core priorities. NACOE delivered guidance aiming to provide opportunities to improve safety at unprotected multilane right turns, which included a risk assessment framework and also researched the optimum time period that should be assessed on the road network to identify road segments with a higher risk of a fatal crash occurrence. The program also strengthened the evidence base for managing structural assets under real conditions, improving understanding of component performance, and supporting more confident inspection, maintenance and renewal decisions. It also advanced practical guidance on durability, resilience and complex asset management, enabling safer infrastructure and more risk-informed, whole-of-life outcomes. These insights support safer, more confident decisions about asset maintenance and replacement, underpinned by robust data and advanced assessment techniques.

Resilience continues to be a growing focus for the program. This year we identified credible pathways to increasing the use of recycled and alternative materials, and assess whole of life costs—while maintaining the safety, durability and performance expected of Queensland's transport infrastructure.

On behalf of the Board, I thank all partners and contributors for their commitment during 2024–25. Together, we continue to strengthen Queensland's transport system and prepare it to meet future demands with confidence.

Dennis Walsh

CHAIR | CHIEF ENGINEER (ENGINEERING AND TECHNOLOGY)
Queensland Department of Transport and Main Roads

BENEFITS OF NACOE

NACOE continues to deliver strong benefits to TMR and the Queensland community in many areas such as economic, safety, and sustainability. The program has delivered many high-value research projects since its inception across performance, technology, productivity, sustainability, safety, and resilience.

Some of the key benefits of NACOE to date include:

- Advancing intelligent construction technologies that improve pavement quality, and reduces rework costs.
- Reducing asphalt and pavement thickness requirements through improved materials research, lowering construction costs, shortening delivery timeframes, and achieving meaningful sustainability gains.
- Increasing the use of recycled materials such as reclaimed asphalt and tyre rubber, turning waste streams into reliable engineering resources for Queensland roads.
- Supporting more accurate, data-driven asset management practices that reduce whole-of-life costs for the transport network.
- Strengthening risk management for planning, design, and maintenance through evidence-based guidance that improves infrastructure reliability.
- Enhancing structural assessment methods, giving engineers a clearer understanding of how bridges and pavements behave under real traffic loads and improving decision-making about maintenance, strengthening, or replacement.
- Delivering new safety-focused research that helps reduce severe crashes at high-risk locations and supports better operational decisions across the network.
- Enabling more efficient network operations through improved access to traffic data, smarter congestion management approaches, and modernised ITS and electrical maintenance practices.

NACOE research continues to prioritise funding to projects with clear and tangible benefits for Queensland's transport infrastructure and its operations.

PROGRAM IMPLEMENTATION

A core objective of NACOE is turning research into practice. Each year, the program focuses not only on generating new knowledge, but on ensuring that this knowledge is usable, accessible, and systematically embedded into Queensland's transport planning, design, construction, and maintenance activities.

Implementation this year was achieved through integrating research outcomes into:

- Technical notes, guidance updates, and refinements to design practices
- New and revised technical specifications that support consistent, modern engineering practice
- Field trials and demonstration projects that validate research outcomes under Queensland conditions
- Learnings through presentations, seminars, webinars, and targeted industry engagement
- Presenting technical papers at key industry forums
- Data collection and analysis to validate and refine existing practices

Research is delivered through carefully selected methodologies that ensure effort is proportional to the potential benefits. These include:

- Desktop reviews to build foundational understanding and confirm the value of progressing to detailed investigation
- Follow-on studies incorporating laboratory testing, modelling, and field validation where results show clear potential for implementation

This approach ensures that NACOE delivers applied research with direct pathways to adoption, strengthening TMR's capability and supporting better outcomes for Queensland's transport network.

CAPABILITY DEVELOPMENT, COLLABORATIONS & AWARDS

- TMR, NTRO, and Main Roads Western Australia won the prestigious International Road Federation Emergency and Disaster Response Management Award in Athens for their collaborative development of a framework to embed bushfire considerations in transport infrastructure design.
- NACOE partnered with industry including Adbri and RoadTek to validate General Purpose Limestone cement performance in real-world pavement applications. The research attracted considerable industry interest and continues into Year 2 with additional innovative cement products.
- Working with the Australian Research Council and four leading universities (UNSW, QUT, University of Adelaide, and University of Melbourne), NACOE advanced the development of standardised testing methods and reliable design parameters for geosynthetic-reinforced pavements, progressing toward field trials that will enable confident, cost-effective use across Queensland's network.
- NACOE continued investment in PhD research programs addressing expansive soils management and granular materials characterisation, including innovative work with Central Queensland University investigating coal mining waste as a partial lime replacement in soil stabilisation, fostering the next generation of pavement specialists.
- The joint NACOE-WARRIP sustainability assessment (SAT4P) tool completed comprehensive quality assurance processes, positioning this whole-of-life sustainability and economic assessment platform for launch with industry participants.
- Since launch, the Recycled Materials Supplier Dashboard has grown to feature 92 product listings from 28 suppliers across 8 TMR districts, with 4 new suppliers joining and monthly additions continuing to increase awareness of recycled material sources across Queensland.
- The publication of 192 reports from 2013 to 2025, which are available on the NACOE website.
- The delivery of numerous online webinars, which are published on the NACOE website and YouTube.

PAVEMENTS

DRIVING INNOVATION, PERFORMANCE, AND SUSTAINABILITY IN ROAD CONSTRUCTION

The Pavements stream remains the largest area of the NACOE program, representing over a third of total investment. It delivers practical, evidence-based improvements to Queensland's road construction and maintenance practices through strong collaboration with industry, academia, and TMR districts.

In 2024–25, the program advanced sustainable material use, emissions reduction, and performance-based testing while introducing innovations in design, construction, and durability that continue to strengthen the resilience and value of Queensland's road network.

THE STREAM DELIVERS BENEFITS TO TMR THROUGH RESEARCH THAT INFORMS:

- Developing consistent testing methods that allow engineers to confidently utilise local and recycled materials across Queensland.
- Reducing emissions and material costs through the use of lower-carbon cement, warm mix asphalt technologies, and the reuse of materials such as reclaimed asphalt and rubber derived from end-of-life tyres.
- Improving pavement strength and lifespan by testing new binders, additives, and compaction techniques that demonstrate strong performance under real-world conditions.
- Applying intelligent construction technologies that make road construction more efficient, faster, precise, and better documented, enabling improved quality control and data-driven decision-making, ultimately leading to longer-lasting pavements.
- Providing practical design tools that show how reinforced materials can enhance pavement strength and reliability, particularly on challenging soils.
- Partnering with universities and industry to build capability in key areas including decarbonisation, innovative materials, and long-term pavement performance.

Together, these projects demonstrate NACOE's continued leadership in translating pavement engineering knowledge into practical outcomes—delivering safer, longer-lasting, and more sustainable roads for Queensland.

P34: DEVELOPMENT OF PERFORMANCE-BASED EVALUATION PROTOCOL FOR NON-STANDARD GRANULAR PAVEMENT MATERIALS

Non-standard granular pavement materials offer a pathway to enhanced network resilience, particularly in remote and rural areas where access to conventional materials may be limited and supply chain constraints can impact construction timelines and costs.

As the project enters its sixth year, NACOE's research continues to strengthen the resilience of Queensland's road network by developing robust evaluation protocols that enable the confident use of locally sourced non-standard materials. This work directly addresses the challenge of maintaining pavement performance when faced with resource constraints, climate variability, and the increasing demand for sustainable construction practices.

The work throughout this year has advanced the project's focus toward creating a resilient material selection framework. A critical component of this work has been Extra-Large Wheel Tracker (XL-WT) testing, which simulates the effects of real-world heavy traffic on pavement materials under controlled laboratory conditions. Over the past two years, four non-standard materials have been assessed at varying moisture levels, revealing that certain materials perform more effectively at lower moisture contents. This testing helps predict pavement performance, ensures that mix designs meet durability requirements, and supports consistent and cost-effective solutions for performance on Queensland roads, enabling TMR to make informed decisions about material suitability before construction begins.

The ongoing work reinforces TMR's commitment to building a road network that Queensland communities depend on.

P58 & O36: ALTERNATIVE CEMENTITIOUS BINDERS FOR COST-EFFECTIVE AND SUSTAINABLE TRANSPORT INFRASTRUCTURE

NACOE has joined hands with industry partners to initiate research investigating the potential for using alternative lower-carbon cement in pavement construction. Cement and concrete products are among the largest embodied carbon emitters in infrastructure projects, making this a strategic priority for reducing the environmental impact of road construction.

Traditional cement production generates substantial carbon emissions, largely due to clinker component. General Purpose Limestone (GL) cements reduce these emissions by incorporating more limestone than conventional General Purpose (GP) cements, effectively replacing high-carbon clinker with a lower-emission alternative. This increased limestone content delivers embodied carbon reductions but requires validation of real-world performance.

Through collaboration with industry partners, NACOE P58 focused on validating the performance of lower-carbon cement alternatives through comprehensive trials comparing the two cement types in fixed-form paved concrete pavement and cast-in-situ structural concrete. Both cement types demonstrated comparable structural performance meeting or exceeding the specified requirements in almost all test cases.

The trials also showcased measurable carbon reductions: pavement mixes reduced embodied carbon by approximately 28.0 kg CO_2-equivalent per cubic metre of concrete, while precast panel mixes achieved 26.3 kg CO_2-equivalent per cubic metre, and grout mixes delivered 61.7 kg CO_2-equivalent per tonne. These results strongly demonstrated that lower-carbon cement can be effectively used in road infrastructure and structural concrete applications.

The combination of measurable carbon savings with the higher limestone content and proven field performance has attracted considerable industry interest in implementing this option as a practical solution. The collaborative approach to this research has been essential in ensuring the trials reflect real-world construction conditions and deliver outcomes that can be readily adopted across Queensland's infrastructure program.

Building on the success of Year 1, the research is continuing into Year 2 to investigate additional innovative cement products and alternative supplementary cementitious materials. The project aligns directly with opportunities to support Queensland's emissions reduction targets, with potential for future trials.

EXPANDING APPLICATIONS: CEMENT STABILISATION

To further expand the use of lower-carbon cements in pavements, a parallel research study examined using GL cements in pavement stabilisation. General Blend (GB) cement, which combines a GP cement with a supplementary cementitious material such as fly ash (FA), is widely used in stabilised pavements across Queensland. This presents another significant opportunity for emissions reduction through material substitution.

Project O36 complements P58 by evaluating a GL cement as a stabilising agent compared with conventional GB cement. Year 1 completed a comprehensive literature review and laboratory assessment to better understand the performance characteristics of these alternative binders in stabilisation applications.

In Year 2, the study evaluated GP and a GL cement blended with 40–60% FA through comprehensive laboratory testing. The laboratory results guided the selection of two mix designs for field trials on a lightly-bound base layer. Results showed that GL cement with 40% FA matched or exceeded the performance of GP cement blends, with in situ tests confirming superior strength at both 7 and 28 days. Although the GL mix required a higher binder dosage, its strength and potential for longer pavement life may justify the trade-off. These findings demonstrate the viability of GL cement for reducing carbon emissions while maintaining performance, supporting its adoption in sustainable pavement construction and alignment with circular economy principles.

Together, these linked projects demonstrate how a single material innovation—the use of limestone-based cement—can deliver carbon reductions across multiple pavement applications, from structural concrete to stabilised base courses.

By establishing performance equivalence in both contexts, NACOE's research provides TMR with practical, lower-carbon solutions that maintain the quality and durability standards required for Queensland's transport infrastructure.

P111: IMPROVED CRUMB RUBBER MODIFIED BINDER SPRAYED SEALING PRACTICES

The continued development of crumb rubber modified binder (CRMB) applications transforms a significant waste stream into a valuable construction resource, directly addressing the environmental challenge of end-of-life tyre disposal while enhancing pavement durability.

With millions of vehicle tyres reaching end of life annually in Australia, diverting this material from landfills delivers substantial environmental benefits. CRMB not only reduces waste but also improves the performance properties of bituminous binders in sprayed seals and asphalt layers, demonstrating that sustainability and quality are complementary goals rather than competing priorities. The use of CRMB is rapidly advancing in Queensland.

The earlier stages of Project P111 focused on improving the quality and performance of CRMB sprayed seals. An experimental program compared the properties and spraying behaviour of polymer modified binders (PMB), CRMB, and unmodified sprayed seal binders. This work confirmed that existing bitumen sprayers and binder material properties do not present fundamental barriers to the successful use of CRMB.

In Year 6, the project shifted focus to field practices—investigating the operational factors that influence quality outcomes when using CRMB in sprayed sealing. The experiences of practitioners from across Australia were collated and analysed to identify common challenges and successful techniques that can inform practice in Queensland.

Interviews with industry practitioners confirmed that most bitumen sprayers can apply CRMB effectively when proper controls are in place. While operational preferences such as nozzle selection and maintenance routines varied, consistent themes emerged around the need for frequent cleaning, careful temperature management, and adherence to blending procedures. CRMB was also reported to perform well in cooler conditions and has been successfully used across a range of sealing applications.

Findings from this work will be used to guide for practitioners, providing clear guidance to help standardise and improve CRMB usage across Queensland. By supporting the wider adoption of crumb rubber binders, this research helps TMR reduce waste from end-of-life tyres and advance its sustainability goals without compromising the performance or longevity of Queensland's road network.

P148: NEXT GENERATION BITUMINOUS BINDERS (E.G. HYBRID-AND BIO-) TO INFORM PERFORMANCE RELATED CHARACTERISATION OF BINDERS

Asphalt pavements and sprayed seals represent a significant investment for TMR, creating a need to identify improved testing methods that maximise value and reduce the risk of poor performance. Current testing methods have worked adequately for traditional binders, but they do not effectively evaluate new materials entering the market, such as next generation polymer modified binders (PMBs), hybrid binders, and bio-binders that could offer better performance or sustainability benefits.

Recent research has identified improved testing methods capable of predicting real-world performance; however, they were developed using instruments (dynamic shear rheometer, DSR) from single suppliers, raising questions about whether different brands of DSRs currently used across Australia produce equivalent results.

NACOE has validated performance-based test methods across multiple DSRs to enable their full implementation in TMR specifications. One of these performance-related test methods is the stress ratio at 10°C test, which was developed to evaluate the fatigue resistance of polymer modified binders (PMBs). This year, work was conducted to determine whether alternative DSRs would result in different outcomes to the original reference DSR. The research involved conducting this test on a range of binder samples using three different DSRs (including the reference DSR) and showed that all three DSRs produced equivalent stress ratio test results.

This year, NACOE also prepared a revised version of the DSR consistency 6% at 60°C test method that was developed to evaluate the rut resistance of PMBs. Improving test methods like this ensures consistent and comparable results, enabling the adoption of higher performing and more sustainable next-generation binder technologies.

This work supports the development of specifications for new binder materials including next generation PMBs, hybrid binders, and bio-binders, while allowing existing binders to be tested for performance-related properties. The outcome is improved confidence in material selection and reduced risk of pavement performance issues.

P149: MOISTURE SUSCEPTIBILITY OF ASPHALT MIXES

Currently, TMR requires hydrated lime in many asphalt mixes to prevent moisture damage. While this is effective, hydrated lime has a relatively high carbon footprint. Industry has identified alternative additives in the form of liquid anti-stripping agents (LAAs) that could perform just as well while performing lower emissions. This multi-year NACOE project aims to assess the effectiveness of these alternatives to manage the risk of moisture damage in asphalt pavements.

NACOE is testing whether these alternative additives can replace hydrated lime without compromising pavement performance. If successful, TMR could reduce carbon emissions from asphalt production while maintaining the high-quality road network Queensland depends on.

This year, a laboratory testing program was established, and evaluation has begun using local aggregate sources and several bitumen adhesion agents. The approach, including plate stripping, boiling water, tensile strength ratio and Hamburg wheel tracking tests ensures that TMR gains a better understanding of these LAAs and the moisture susceptibility of TMR asphalt mixes.

Asphalt stripping observed during the tensile strength ratio test

Asphalt stripping observed during the Hamburg wheel tracking test

P160: METHOD FOR DETERMINING DESIGN PARAMETERS OF REINFORCED PAVED FLEXIBLE PAVEMENT

The pavement industry is increasingly challenged to deliver durable, high-quality pavements amidst evolving environmental conditions and constrained budgets. Geosynthetics, including geogrids and geo-composites, have emerged as effective solutions for enhancing pavement resilience and longevity. When incorporated within the base course layer, these reinforcements increase stiffness, improve the bearing capacity of weak subgrades, and enable thinner pavement designs that reduce material use and cost. Yet despite their clear benefits, broader adoption across Australia has been limited by the absence of standardised testing methods and reliable design parameters.

Project P160 is addressing this gap through a major collaborative research effort involving NACOE, the Australian Research Council (ARC), and four leading universities: UNSW, QUT, the University of Adelaide, and the University of Melbourne. This partnership reflects the strength of NACOE's academic–industry collaboration model, with NACOE actively involved in technical discussions, trial planning, test reviews, and on-site activities that help shape the methods under development.

In 2024–25, the project made major progress toward creating reliable, scalable testing methods that will allow geosynthetic reinforcement to be used with confidence in Queensland pavements. Laboratory work this year focused on proving that the new test equipment and procedures produce consistent and repeatable results, while also strengthening the understanding of how different geosynthetics improve pavement strength and reduce long-term deformation. To complement this, modelling work helped confirm that the laboratory methods reflect real-world pavement behaviour. Together, these activities ensure the emerging test framework is practical, robust, and suitable for future specification development.

The project also advanced toward real-world validation, completing the planning and preparation required for upcoming field trials. Test sections were designed, materials and reinforcement layouts were confirmed, and sensors were installed to allow future monitoring. The project has since progressed into field construction and data collection, ensuring Queensland will soon have high-quality evidence to guide the practical use of geosynthetic reinforcement in pavement projects.

By working closely with universities and industry, NACOE is helping TMR develop practical, evidence-based design parameters that support more resilient, cost-effective pavement solutions across Queensland's road network.

P179: INTELLIGENT CONSTRUCTION TECHNOLOGY FOR BETTER ROADS IN QUEENSLAND

Enhancing productivity in road construction requires technology that delivers accurate, efficient outcomes while reducing rework and construction delays. Intelligent Construction Technology is reshaping Queensland's construction practices by providing real-time data and precision control that improve quality, reduce waste, and support more resilient pavement outcomes across the network.

Intelligent Compaction (IC) and Thermal Profiling are at the core of this shift. IC uses rollers fitted with integrated sensors and high-precision GPS to measure and map compaction in real time, ensuring uniformity that traditional spot testing cannot guarantee. Thermal Profiling, including advanced paver-mounted systems, captures continuous temperature data behind the paver to identify segregation and temperature variability—factors that strongly influence asphalt durability. Together, these technologies remove much of the guesswork from construction and support consistent, high-quality outcomes across projects.

In 2024–25, NACOE's work progressed from trials and demonstration toward formalising these technologies for broader adoption. This year delivered the drafting of two major specification updates that establish clear technical requirements for IC and Thermal Profiling. These specifications provide the framework to adopt the technologies reliably and consistently, enabling TMR to move from early exploration towards targeted implementation. NACOE also drafted additional supporting materials, including proposed project-specific technical specifications, checklists, and guidance documents that will help districts and contractors integrate the technologies into day-to-day practice.

Alongside specification development, the project continued field demonstrations and industry engagement to build capability across the workforce. This included thermal profiling demonstrations—the first of their kind in Australia—as well as information sessions, stakeholder workshops, and on-site support for IC deployment on asphalt and unbound material projects. These activities ensure that both TMR and industry partners understand how to use the technologies effectively and can transition smoothly to performance-based construction methods.

The project has since moved into the implementation phase, with the specifications now being applied and refined through targeted field trials. These trials are assessing how IC, Thermal Profiling, 3D milling and paving, and dielectric profiling can improve accuracy, reduce rework, and provide more reliable construction records that strengthen TMR's long-term asset outcomes.

By equipping the construction supply chain with precise tools, clear specifications, and practical guidance, NACOE is enabling a step change in how Queensland builds its roads. The tangible outcomes delivered this year—particularly the development of two new specifications—position TMR to achieve more consistent quality, improved productivity, and long-term value across the state's road construction program.

P181: INDUSTRY RESEARCH TRAINING GROUP – CONSTRUCTION OF PAVEMENTS ON EXPANSIVE SOILS AND TOWARDS A BEST PRACTICE FRAMEWORK FOR CHARACTERISING GRANULAR MATERIALS IN PAVEMENT APPLICATIONS

Supporting university-led research continues to be a key component of NACOE's commitment to people development and industry collaboration. The initiative aims to strengthen Queensland's research capability in two critical areas for the state's transport network: expansive soil management and the characterisation of granular pavement materials.

Expansive soils present a significant challenge to the durability and performance of Queensland's road infrastructure, particularly in regional areas where these materials are widespread. Through a combination of literature reviews, field monitoring, and treatment cataloguing, the research is identifying best-practice approaches to mitigate the effects of soil movement on pavements. The project catalogues and evaluates a range of treatment options, considering their technical details, targeted outcomes, long-term maintenance implications, and indicative costs. Field monitoring on TMR sites captures seasonal variations and performance trends, helping to refine design procedures and specifications for pavements constructed on expansive soils.

In parallel, the Characterisation of Granular Pavement Materials research stream is aimed at improved characterisation of the performance of non-standard granular materials to improve the resilience and sustainability of Queensland's road network. The PhD work will develop a best practice performance-based laboratory evaluation protocol that will facilitate the fit-for-purpose and cost effective use of locally sourced pavement materials

Together, these PhD research projects are fostering the next generation of pavement and materials specialists while supporting potential updates to TMR pavement design procedures and specifications. By investing in applied academic research, NACOE is not only addressing technical challenges in expansive soils and the use of local materials but also ensuring Queensland's transport network remains sustainable, resilient, and prepared for future demands.

P168: IMPROVED RESILIENCE OF UNBOUND GRANULAR PAVEMENTS

Unbound granular pavements form the backbone of Queensland's road network, particularly in regional and rural areas. Their performance is highly sensitive to moisture, material variability, and construction practices, making resilience a critical consideration for network reliability and whole-of-life performance.

Building on earlier research, Project P168 continues to strengthen Queensland's approach to managing unbound granular pavements by improving how material performance is assessed before construction. The work responds to growing pressures to use a wider range of materials, including recycled and locally sourced options, while maintaining confidence in pavement durability and performance

During 2024–25, the project progressed with targeted laboratory testing to better understand how different unbound granular materials behave under traffic loading and varying moisture conditions. Large-scale testing focused on examining how changes in moisture influence deformation and long-term performance. This work is helping to clarify where current test methods align with field behaviour and where refinements are needed to better reflect real-world pavement conditions.

The outcomes from this year's work are informing the development of a more reliable performance assessment protocol for unbound granular pavements. By improving the link between laboratory results and in-service performance, the project supports more confident material selection, reduces the risk of premature pavement failure, and enables the considered adoption of alternative materials where appropriate.

This research strengthens TMR's ability to deliver resilient, cost-effective pavements across diverse environments, supporting better investment decisions and a road network that performs reliably under Queensland's demanding conditions.

Extra-large wheel tracking device

Deformation of granular material observed in the extra-large wheel tracking device

ASSET MANAGEMENT

BUILDING SMARTER NETWORKS THROUGH DATA, INSIGHT, AND INNOVATION

Asset management sits at the core of how TMR plans, maintains, and invests in Queensland's transport network. NACOE's research in this stream focuses on strengthening that foundation—delivering tools, models, and evidence that enable better long-term decisions for both infrastructure and sustainability.

This year, NACOE continued its examination into how the growing shift to low and zero emission vehicles will affect Queensland's road network. The findings give TMR a clearer understanding of how to balance maintenance budgets, emissions goals, and freight efficiency as the network evolves.

Alongside this work, NACOE supported the establishment of Queensland's first roughness calibration loop, improving the accuracy of road condition testing and allowing local validation without the need for interstate facilities.

THE STREAM DELIVERS BENEFITS TO TMR THROUGH:

- Using lifecycle modelling to understand the long-term costs and carbon impacts of emerging vehicle technologies.
- Integrating carbon emissions and cost data into asset management systems to support evidence-based investment.
- Establishing local validation loops that improve data quality and reduce operational costs for condition testing.
- Providing insights that help balance network performance, sustainability, and cost-effectiveness.
- Supporting TMR's capability to plan for a transport future that is more efficient, low-emission, and resilient.

By building smarter asset management systems and practical testing tools, NACOE is helping TMR create a transport network that remains safe, sustainable, and future-ready.

A68: IMPACT ASSESSMENT OF THE INTRODUCTION OF LOW AND ZERO EMISSION HEAVY

NACOE continues its work investigating the pavement impacts of low and zero emission (LZE) heavy vehicles weighing over 4.5 tonnes. As the transport sector shifts toward more sustainable solutions, understanding how these vehicles affect road infrastructure is critical for maintaining network productivity, building resilience into long-term planning, and supporting decarbonisation goals.

NACOE has examined emerging vehicles and their implications for road maintenance costs and network constraints. The second year of the project has expanded the scope to include pavement impact analysis under budget constraints. This informs how Queensland can manage the LZE transition within existing financial limitations while maintaining network productivity and resilience. The analysis now encompasses a consideration of costs and benefits, including impacts on local pollutants, CO2 emissions, vehicle operating costs and crash-related impacts associated with specific freight tasks.

Delivered in close collaboration with Austroads project NEF6392 (Future Freight Vehicles and Buses – Implications for Road Managers), this NACOE project leverages shared methodologies and aligned findings to strengthen both initiatives. Collectively, the projects provide TMR with a robust, evidence-based foundation to inform infrastructure planning, asset management, and policy development as LZE heavy vehicles play an increasingly significant role in the freight task. The findings from this project will support TMR to:

- Inform policy regarding the adoption of LZE heavy vehicles and the implications for road network management, particularly pavements and surfacings, including insights into potential uptake levels and corresponding impacts.
- Determine expected maintenance and upgrade needs across the road network and inform the funding mechanisms required to support those activities.
- This approach delivers an accurate whole-of-life picture of the sustainability, resilience, and productivity impacts from transitioning to LZE heavy vehicles. This ensures the network continues to move goods efficiently while transitioning to cleaner vehicle technologies.

A67: NETWORK LIFECYCLE MODEL FOR EMBODIED CARBON AND EMISSIONS

Building on the findings of A68, NACOE expanded the analysis to quantify the broader emissions and societal costs associated with transition to low and zero emission (LZE) vehicles. While A68 examined the physical impacts of heavier electric vehicles on pavements, A67 focused on the emissions and economic implications of that transition covering embodied emissions from maintenance activities and enabled emissions from vehicles operating on the network.

This whole-of-life research modelled the impacts of more than 1,200 road segments of Queensland's road network, representing approximately 11,000 kilometres, to evaluate how different uptake scenarios of LZE vehicles will influence total transport costs. These scenarios considered a range of maintenance budgets and fleet transition levels, from minimal uptake through to full electrification. The modelling incorporated road agency costs, vehicle operating costs, crash costs, travel time and freight delay costs, as well as the carbon value of both embodied and operational emissions.

By integrating lifecycle emissions and cost analysis with TMR's pavement management systems, these projects provide a strategic decision-support framework for balancing maintenance performance, emissions reduction, and overall network sustainability. Together, this work equips TMR with a holistic view of the costs and benefits of the coming transition to increased electric vehicles informing long-term investment planning and strengthening Queensland's readiness for the LZE era.

A69: ROUGHNESS TEST LOOP IN QLD

When TMR rehabilitates or constructs new roads, testing the roughness of the newly improved road is an important part of quality control. Many studies have shown that a road that is constructed to provide a reasonably smooth surface for road users reduces costs for road users through fuel and travel time savings and stays smoother for a long time which reduces the need for maintenance treatments. Service providers with laser profilers complete the testing of the improved road sections. But who tests the service providers?

Service providers and contractors operating in Queensland are contractually required to conduct testing of new road surfaces but can only do so with equipment that has been appropriately validated. Currently, Queensland-based service providers must travel to Gosford, NSW, to utilise Transport for NSW's validation loop for roughness testing. This requires considerable time of at least 2 days journey and cost burdens that affect the commercial viability of maintaining roughness measuring devices in the state.

NACOE established a local roughness validation loop in Queensland to address this challenge, eliminating the need for interstate travel while ensuring testing equipment meets the same rigorous validation standards.

A suitable roughness calibration loop has been identified, verified, and documented. The loop has been optimised to ensure data collection can be completed within one working day, providing efficient access for service providers while maintaining validation accuracy.

During 2024/25 works included testing of the loop using walking profilers which are the reference device for mobile laser profilers. Walking profilers may look like a lawn mower, but the devices provide an extremely accurate measure of the profile of the road surface.

Walking profilers were used to test both the left and right wheel path of various parts of the road and then the mobile laser profiler also tested the same parts of the road. The two sets of results were compared and demonstrated the accuracy of the devices.

The work culminated in an agreed roughness test loop that can be used to validate laser profilers. NTRO will offer the certification of results as part of managing the loop.

The project positions Queensland with the infrastructure needed to validate testing equipment efficiently while maintaining the standards required for reliable road surface condition assessments.

Asphalt stripping observed during the Hamburg wheel tracking test

STRUCTURE

BUILDING RELIABLE, LONG-LASTING STRUCTURES FOR QUEENSLAND

The Structures discipline continues to strengthen how the Department of Transport and Main Roads (TMR) assesses, designs, and maintains bridges and structures across the state. This year's work advanced Queensland's understanding of structural behaviour, durability, and long-term performance, helping ensure safer, more resilient assets and more consistent decision-making across the network.

Research delivered new insights into how legacy structural details behave in real conditions, including refined methods for assessing structural capacity, and progressed options for performance-based concrete specifications that support innovation while maintaining durability. Work also advanced Queensland's preparedness for upcoming sustainability challenges by examining future material availability and pathways for lower-carbon concrete technologies.

THE PROGRAM DELIVERS BENEFITS TO TMR THROUGH:

- Improving structural assessment methods that allow safer, more confident decisions about repair, strengthening, or replacement.
- Providing clearer guidance for inspecting complex or hard-to-access bridge elements, improving consistency across districts.
- Advancing performance-based concrete durability approaches that enable lower-carbon and innovative concrete mixes without compromising longevity.
- Reducing risk by improving understanding of how vulnerable structural details behave under real loads and environmental conditions.
- Supporting long-term sustainability planning through research into future concrete materials and the availability of key supplementary cementitious products.
- Strengthening collaboration between TMR, universities, and industry to accelerate adoption of modern materials, testing methods, and structural assessment tools.

Together, this work ensures Queensland's structures remain safe, durable, and cost-effective, while enabling the innovation needed to meet future network and sustainability demands.

S62: MANAGEMENT OF STRUCTURES WITH CONCRETE HALVING JOINT - SCALE MODEL TESTING PROJECT

TMR manages 57 legacy bridge structures containing concrete halving joints across the network. A halving joint is a structural detail where part of the girder or headstock is “halved” to create a stepped support. Although this detail was compliant with past design standards, it is now recognised as vulnerable because it combines a reduced cross section with high localised shear forces. These joints are difficult to inspect and are often located near deck joints where water and contaminants can accelerate deterioration. International failures of similar details highlighted the importance of understanding and managing the risk.

Without accurate assessments of actual structural behaviour and capacity, these portions of the road network could be either prematurely replaced or allowed to deteriorate beyond acceptable limits. Both scenarios impact network productivity and impose unnecessary costs.

To address this, TMR launched the Management of Structures with Concrete Halving Joints project. Under the NACOE research program, the S62 Project began in 2021 to deepen technical understanding of the behaviour, capacity and long-term performance of halving joints across the Queensland network.

S62 has delivered a coordinated program of literature review, field investigation, advanced non-linear finite element modelling and targeted laboratory testing.

KEY OUTCOMES INCLUDE:

» Durability findings: No significant durability issues were found across TMR’s halving joint portfolio, contrasting with international experience where de-icing salts create severe deterioration.

» Fatigue assessments: Measured data indicates very low fatigue risk for both concrete and steel reinforcement, even where minor crack movement is present.

» Advanced modelling: Non-linear finite element analyses provided improved insight into actual structural behaviour, indicating capacities up to 25% higher than those estimated by conventional Strut-and-Tie methods.

» New experimental data on pre-tensioned strands was developed, improving model calibration and indicating higher strand capacity than current standards suggest.

» Inspection guidance: New, behaviour-based inspection guidance was developed for both pre-tensioned and post-tensioned halving joints.

Together, these achievements strengthen TMR’s risk-based benchmarking framework and support safer, more consistent decision-making for halving-joint bridges across Queensland.

S76: PERFORMANCE BASED CONCRETE SPECIFICATIONS FOR DURABILITY PERFORMANCE

Current concrete specifications, including TMR's MRTS70, establish durability through prescriptive requirements such as defined cement contents, water ratios, reinforcement cover depths, and curing durations. Concrete produced that follows these parameters is deemed to comply with expected performance. While this approach provides simplicity and consistency, it can limit innovation. Concrete suppliers who want to reduce cement content to lower carbon emissions through using alternative materials have no alternative pathway to prove their products meet or exceed durability requirements.

NACOE is investigating how to shift toward measuring how well does the concrete perform? Performance-based specifications would establish measurable durability targets rather than dictating specific mix parameters. If suppliers can demonstrate through testing that their concrete achieves these performance thresholds, they may gain flexibility in how they formulate their mixes.

International jurisdictions including Canada, Europe, and South Africa have developed frameworks that can accept concrete performance through durability testing. The research is examining how a Queensland specification framework could learn from these international specifications, once validated against local materials and environmental conditions.

Year 24/25 is using learnings from European ‘equivalent durability procedure’ to prepare a performance-based testing program. This program will establish the real-world baseline performance of existing materials in order to inform future limits and requirements.

This approach potentially increases options for sustainable materials and new technologies. Concrete suppliers can optimise mixes to reduce carbon emissions, lower costs, or improve performance, as long as they demonstrate through testing that the concrete will achieve required durability. By establishing measurable performance thresholds validated through testing, TMR can support industry-wide innovation while ensuring Queensland's transport infrastructure remains durable and fit for purpose for decades to come.

ROAD SAFETY

STRENGTHENING SAFE SYSTEM PRACTICE THROUGH DATA, DESIGN, AND INSIGHT

Road safety remains a core priority for Queensland's transport network. NACOE's work in this area supports TMR's commitment to eliminating deaths and serious injuries by translating the Safe System approach into practical, evidence-based guidance that improves how risks are identified, assessed, and managed across the network.

This year's research focused on understanding where the most serious crashes occur, why they happen, and how design, speed management, and targeted interventions can prevent them. NACOE continues to strengthen the tools available to engineers and planners to make consistent, defensible safety decisions across urban and regional roads.

THE PROGRAM DELIVERS BENEFITS TO TMR THROUGH:

- Providing evidence-based guidance to reduce crash risk at complex intersections, particularly on multilane and high-speed roads.
- Using crash and speed data to identify high-risk locations and inform more targeted safety interventions.
- Supporting consistent, data-driven safety decisions through practical assessment frameworks and tools.
- Improving the alignment between road design, operating speed, and real-world driver behaviour.
- Strengthening network-wide safety planning by linking detailed analysis with Safe System principles.

R152: UNPROTECTED MULTILANE RIGHT TURN TREATMENTS RISK MITIGATION GUIDANCE UPDATE

Unprotected right turns across multiple traffic lanes remain one of the most significant intersection safety challenges on Queensland roads. These manoeuvres often involve complex driver decision-making, limited sight distance and more severe impact angles.

NACOE research included a comprehensive literature review comparing Queensland's current practice with national and international approaches, along with a detailed analysis of recent crash data. The study identified key risk factors including traffic speed and volume, number of lanes crossed, sight distance and road user composition as critical influencers of crash likelihood and severity. Statistical modelling confirmed these variables as strong indicators of risk, highlighting where targeted treatments are most needed.

Building on these insights, the project developed a structured risk mitigation matrix to assist practitioners in assessing intersection safety and selecting appropriate design responses. This tool combines quantitative crash data with qualitative site characteristics to inform evidence-based decisions for upgrades and new intersection designs.

The risk mitigation matrix provides a clear framework for prioritising high-risk intersections, recommending practical treatments such as protected or channelised turn lanes and improved signalisation on multilane and high-speed approaches. It also establishes a foundation for ongoing monitoring and refinement of intersection safety strategies.

By delivering a consistent, data-driven approach to intersection design, NACOE is helping TMR proactively manage risk and advance its commitment to eliminating deaths and serious injuries on Queensland roads.

NETWORK OPERATIONS

OPTIMISING HOW QUEENSLAND'S ROAD NETWORK MOVES PEOPLE AND FREIGHT

Network Operations research continues to deliver strong returns for Queensland by improving how the road network is monitored, managed, and optimised. This work enhances the performance of existing infrastructure, reduces the effects of congestion, and strengthens the state's ability to move people and freight safely and reliably.

THE PROGRAM DELIVERS BENEFITS TO TMR THROUGH:

- Improving access to real-time traffic data so planners and operators can make faster, better-informed decisions.
- Standardising maintenance activities for ITS and electrical assets to ensure safe, consistent operation across the state.
- Advancing proactive congestion-management methods, including perimeter control, to protect network performance during peaks and major events.
- Leveraging connected-vehicle data to evaluate and refine traffic signal timing, improving reliability and reducing delay.
- Delivering long-term cost savings by reducing reliance on new infrastructure through better network operations.
- Building statewide capability by working with districts, contractors, and industry to prepare for emerging network technologies.

R100: TRAFFIC DATA ACCESS PORTAL

Continuing from last year's achievements in providing efficient, user-friendly access to Queensland's traffic data, NACOE has advanced the portal's capabilities to deliver more responsive and reliable data access for TMR users.

The challenge that drove this project remains critical: HERE traffic data in its native form is difficult to access and lacks instantaneous retrieval and aggregation reporting without extensive data manipulation and GIS capabilities. This year has focused on addressing these limitations further while enhancing the portal's functionality to support better decision-making across the network.

To support smoother analysis and improve usability, two major enhancements were introduced to the R100 traffic data portal this year. The first relates to how user-defined routes are organised within the system, ensuring they can be stored, managed, and accessed in a more structured way through folder organisation. The second enhancement enables the extraction of spatial route data so TMR staff can easily transfer route information into GIS tools or modelling platforms for further analysis. Together, these improvements make the portal easier to navigate and more powerful for day-to-day network planning and operational tasks.

The improvements made over the past year ensure that this Queensland's traffic data remains easily accessible and user-friendly, supporting TMR's ability to make informed infrastructure planning and network management decisions. The portal's continued evolution demonstrates how efficient data access translates directly into better outcomes for network performance and planning efficiency.

R137: STRENGTHENING MAINTENANCE FOR THE NEXT GENERATION OF SMART ROAD TECHNOLOGIES

Queensland's road network increasingly relies on Intelligent Transport Systems and Electrical (ITS&E) assets to deliver safety, operational efficiency, and energy reduction benefits. These assets require routine maintenance administered under TMR's Road Maintenance Performance Contract (RMPC) framework. However, TMR's Routine Maintenance Guidelines had limited information for ITS&E maintenance activities across the network.

Through project R137, NACOE is embarking on a comprehensive review of work activities associated with maintaining ITS&E assets currently deployed and those likely to be deployed across TMR's network over the next 5 to 10 years. The R137 project aims to standardise and modernise work activities while informing future updates to TMR's internal RMPC framework.

Initial R137 project phases focused on the following high-profile ITS&E assets delivering significant network benefits:

» Non-TRAFF Traffic Signal Controllers with associated Extra Low Voltage components and aluminum-bodied signal lanterns.

» Smart LED Road Lighting luminaires with associated Smart Lighting Controllers.

There is further opportunity to review signal lanterns or other specific ancillary assets such as cabinets, pits, ducts and network equipment. The secondary phase undertaken as part of Year 2 of the project, leveraged off the learnings developed in the initial phases and investigated the remaining work activities associated with traffic signal and road lighting assets.

The systematic approach applied in R137 ensures that the RMPC framework keeps pace with evolving technology deployment across the network, providing contractors with clear technical standards and guidance to deliver consistent routine maintenance. By standardising work activities for both current and emerging ITS&E assets, TMR can achieve value-for-money maintenance delivery while managing network safety and operational performance effectively.

R150: ARTERIAL ROAD NETWORK OPTIMISATION

Urban road networks face increasing congestion challenges, including in areas where traffic signal operations span multiple jurisdictions. Traditional traffic signal control strategies focus on intersection and corridor optimisation. However they may not prevent network-wide congestion once it begins, leading to sharp drops in flow rates and slow recovery across the network. NACOE is investigating perimeter control approaches that offer a proactive way to manage network congestion by limiting vehicle inflow before delays develop, supporting more stable performance across metropolitan areas and during major events such as the 2032 Olympic Games.

Over the past year, NACOE completed a detailed review of global perimeter control theory and practice, identified the University of Queensland as a research partner, and selected Capalaba and Southport as suitable case study networks. The research confirmed that traffic behaviour in the study areas follows a predictable relationship between flow and congestion. This allowed the team to clearly define when the network is operating well and when it is nearing overload, and to establish the performance measures needed to monitor these conditions. These insights formed the basis for designing a perimeter control concept suited to Queensland's arterial road environments.

The project is now progressing through microsimulation, with the Southport activity centre implemented in the simulation environment. This is allowing the team to continue developing perimeter control logic, identify suitable gating locations along the network boundary and test a range of control configurations. Early results are already indicating that coordinated signal strategies have strong potential to prevent congestion before it forms, and further testing is ongoing.

Perimeter control offers a range of benefits, including reduced delays, improved travel-time reliability, enhanced safety through fewer congestion-related crashes, lower carbon emissions from reduced stop-start conditions, and improved amenity such as lower noise levels and more pedestrian-friendly streets.

This work strengthens TMR's ability to apply modern network-management techniques to improve the reliability, safety, and environmental performance of Queensland's busiest activity centres, while laying the groundwork for future operational trials.

SUSTAINABILITY

ENABLING LOWER-CARBON, MORE RESOURCE-EFFICIENT TRANSPORT INFRASTRUCTURE

Sustainability is an increasing focus of the NACOE research program, supporting TMR's shift toward lower-carbon, more resource-efficient transport infrastructure. The work in 2024-2025 strengthened the tools, data, and evidence needed to assess environmental impacts alongside cost and performance, while exploring practical opportunities to increase the use of recycled and alternative materials and reduce reliance on virgin resources.

THE PROGRAM DELIVERS BENEFITS TO TMR THROUGH:

- Providing practical tools and methods that allow sustainability and cost to be assessed together at the project level.
- Expanding safe and effective use of recycled and secondary materials in road construction.
- Improving access to information on recycled material suppliers across Queensland.
- Investigating lower-carbon alternatives to traditional stabilisation and construction materials.
- Supporting informed management of emerging environmental and material-related risks.
- Strengthening collaboration with industry and universities to accelerate sustainable practices.

O28: RECYCLED MATERIALS DATABASE

One of the main barriers to broader adoption of recycled materials has been the lack of awareness about potential suppliers and available products. While TMR and industry innovators have made progress in supporting recycled material use, significant opportunity remains to expand their application across the network.

To increase the use of recycled materials in infrastructure projects, NACOE has advanced the development of a database and dashboard that connects suppliers with infrastructure projects across Queensland.

Project O28 has created a platform accessible to internal and external stakeholders that provides state-wide information about suppliers of recycled materials and products containing recycled content. The dashboard helps contractors to find suitable suppliers across Queensland in completing Waste to Resource (W2R) tender schedules.

The Dashboard is designed to be intuitive and user-friendly, offering features that make it easy to find and evaluate recycled material suppliers across Queensland.

Key functionalities include an interactive map where users can explore supplier locations geographically, helping identify nearby sources and potentially reducing haulage emissions. Users can also view supplier information in tables for easy comparison, search for specific materials or suppliers using filters based on location, material type, or specifications, and access simple charts that provide quick insights into product listings and suppliers.

The Dashboard now features 29 suppliers from 8 TMR districts resulting in 100 different products, with several interstate businesses providing products to Queensland. These suppliers include quarries, recyclers, and manufacturers of bituminous products, with new entries added monthly.

By increasing awareness of local suppliers and available products, the platform drives local markets while supporting TMR's transition toward a circular economy. This enables informed material choices that deliver both performance and environmental outcomes across Queensland's infrastructure program.

O33: SUSTAINABLE USE OF COAL MINE WASTE IN ROAD CONSTRUCTION IN QUEENSLAND

Coal mining waste (CMW) produced from coal extraction and processing represents one of the largest industrial waste streams in Australia's coal mining sector. Coal sludge waste and coal gangue, produced during coal washing and initial separation of coal from surrounding rocks, account for approximately 10-15% of total coal production. With Australia producing over 500 million tons of coal annually as the fourth largest coal producer globally, significant quantities of this waste material accumulate across mining sites while road construction projects continue to demand substantial quantities of traditional stabilising materials like lime and cement.

NACOE in collaboration with Central Queensland University is investigating the feasibility of transforming this waste stream into a valuable construction resource by using coal mining waste as a partial replacement for lime in subgrade stabilisation. With the help of the university's academics and PhD students, this research explores whether CMW can effectively stabilise problematic soils including high plastic clays while addressing multiple objectives: reducing construction costs through use of an abundant, inexpensive material; providing environmental benefits by removing coal mining waste from land.

During the 2024–25 period, Stage 1 of the project focused on a comprehensive laboratory feasibility study to assess the suitability of thermally treated coal mining waste (CMW) for high plastic soil stabilisation. Coal mining waste was ground and thermally activated through calcination at temperatures between 600 °C and 900 °C to enhance its pozzolanic reactivity. Extensive laboratory testing was undertaken to characterise both the CMW and the target soil, including a suite of material characterisation tests to establish their physical and chemical properties. Microstructural and thermogravimetric analyses were also conducted to evaluate the effectiveness of thermal activation of the CMW. Key findings to date indicate that the specific grinding practices and associated treatments were effective for material activation and decarbonation. Unconfined Compressive Strength (UCS) testing on a range of stabilised soil blends with varying binder compositions is currently underway. Preliminary results are promising and suggest that activated CMW has strong potential to partially replace lime in the stabilisation of highly plastic clays. Further UCS testing will confirm whether soils stabilised with activated CMW comply with strength requirements for road construction applications. This stage of the research has been undertaken in close collaboration with Central Queensland University and PhD students, providing valuable research training outcomes alongside technical advancements.

This research positions Australia to lead in developing novel, cost-effective, and sustainable local construction products.

P117: SUSTAINABILITY ASSESSMENT TOOL

SAT4P is an online tool developed as a joint WARRIP-NACOE project for Main Roads Western Australia and TMR that enables concurrent whole-of-life sustainability and economic assessments of pavement designs. The tool allows users to determine which pavement designs deliver optimal cost benefits and lowest greenhouse gas emissions. This detailed assessment supports better-informed decision-making on material selections, maintenance options, and end-of-life choices at the project level.

Separate and discrete databases have been prepared and built-in for each jurisdiction's specific inputs.

This year SAT4P has progressed through comprehensive quality assurance processes that position the tool for preview launch with industry participants. The tool has been subject to rigorous development phases, independent peer review, user acceptance testing by industry experts, and quality assurance processes to achieve a reliable and fit-for-purpose product.

This comprehensive testing process ensures SAT4P provides reliable assessments that enable agencies and industry to make sustainability information accessible and actionable at the project level, supporting Queensland and Western Australia's sustainability objectives.

FEEDBACK AND CONTACT DETAILS

The NACOE Agreement Managers can be contacted with any feedback or enquiries regarding the program or for information on specific projects at info@nacoe.com.au.

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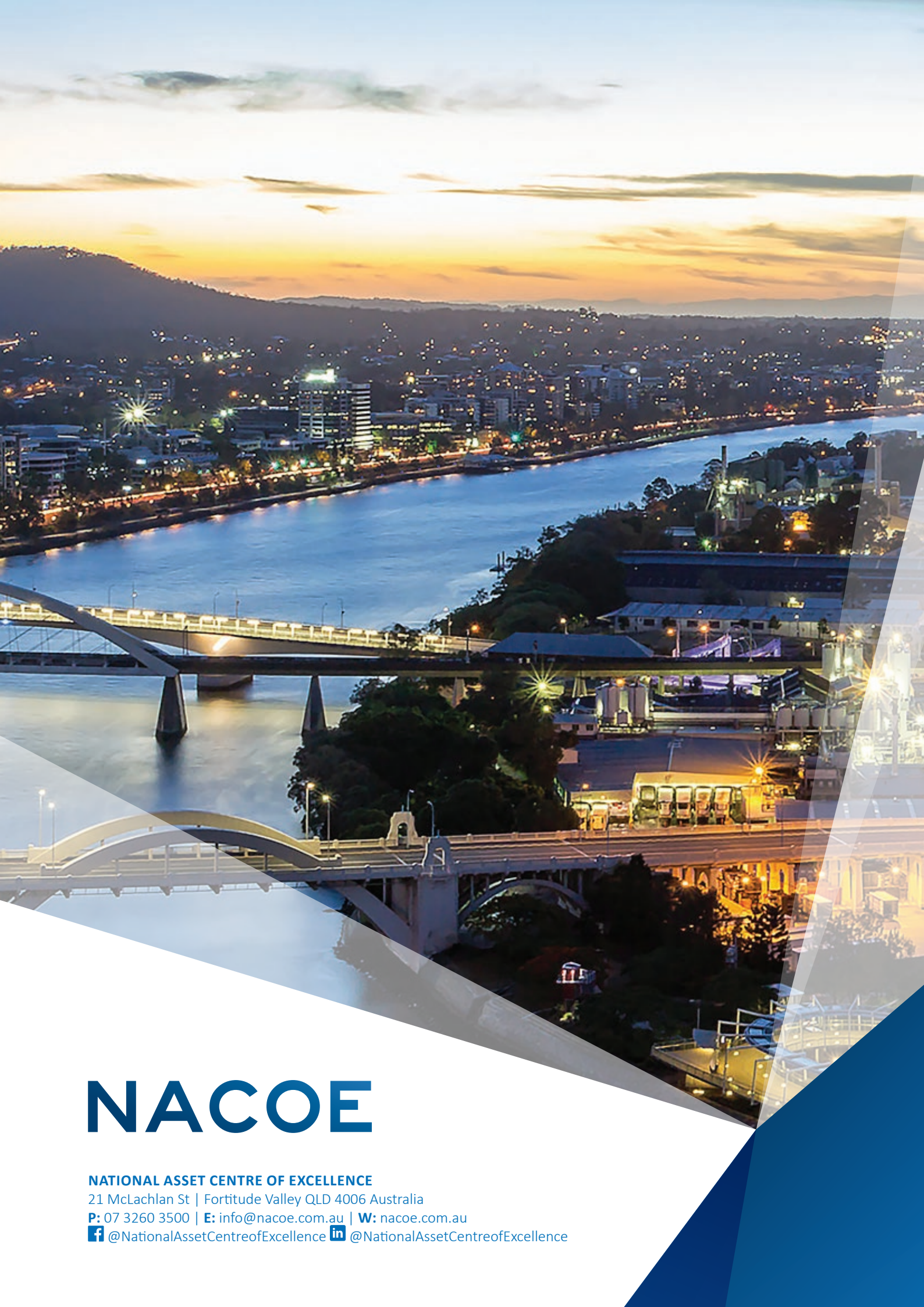
GET INVOLVED

The NACOE Program runs on a rolling four-year basis, with projects generally spanning one to three years.

The program relies heavily on input and collaboration between TMR, NTRO, and industry personnel to develop ideas for projects across seven key research areas of pavements, asset management, structures, network operations, heavy vehicle management, road safety and sustainability.



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