



STRATEGIC PLAN 2023 - 2025

Including Business Plan 2023

April 2023



STRATEGIC PLAN 2023 - 2025

Including Business Plan 2023

Prepared by

Sharon Biermann

Version control

FINAL

About PATREC

The Planning and Transport Research Centre (PATREC) is a collaboration between the Government of Western Australia and local universities, constituted to conduct collaborative, applied research and teaching in support of policy in the connected spaces of transport and land use planning. The collaborating parties are: The University of Western Australia, Curtin University, Edith Cowan University, Department of Transport, Main Roads Western Australia, Western Australian Planning Commission and the Western Australian Local Government Association.

Publisher

Planning and Transport Research Centre
The University of Western Australia (M087)
35 Stirling Highway, Crawley, WA 6009
+61 8 6488 3385
patrec@uwa.edu.au
<https://patrec.org/>

Executive Summary

The purpose of this Strategic Plan 2023-2025 (the Plan) is to set out the broad strategic direction of PATREC for the three-year period 2023-2025, also providing a more detailed action-focused Business Plan for the inner year, 2023. PATREC Strategic Plans are revised every three years with any interim strategic updates included as part of the annually prepared Business Plans.

This Plan is an update of the Strategic Business Plan 2020-2022, accounting for subsequent changes in strategic and operational drivers. Most importantly, the Director General Transport has called for a new research program of climate action related to transport and land use planning. This call is in collaboration with the Chairman of the WA Planning Commission and with the backing of the Chief Scientist. This initiative is driven by the Western Australian Climate Policy released in late 2020, providing the focus and catalyst for climate adaptation and emissions reduction in WA. The policy is structured around six key themes, four of which relate to transport and land use planning - government leadership, lower-carbon transport, resilient cities and regions, and storing carbon and caring for our landscapes. It further highlights the need for stronger engagement with industry and research organisations to, inter alia, develop and support technology pathways for net zero emissions.

PATREC's mandate is to conduct collaborative, applied research and teaching in support of policy in the connected spaces of transport and land use planning. Key strategic activities to advance this mandate remain as:

- Multi-disciplinary, multi-institutional applied research in response to identified agency research requirements and knowledge gaps;
- Knowledge transfer through academic and less formal publications, connection events and a website as a reliable and accessible resource for researchers and policy-makers;
- Training, predominantly in the form of professional development through short courses, executive programs and "expert" courses on key topics, conducted in collaboration with other professional and industry bodies where possible; and
- Attracting additional research funds through business development.

In relation to PATREC's more traditional program of research, the research focus areas for the next three years in support of key policy objectives, underpinned by a supportive information and modelling, remain as:

- Integrated land use and transport futures;
- Smarter travel decisions;
- Integrated freight system optimisation;
- Emerging technology and network optimisation and intelligence; and
- Transport infrastructure investment risk management.

Research projects undertaken within these focus areas will inform achievement of the following policy objectives:

- Reducing the need to travel.
- Public transport optimisation.
- More freight onto rail.
- Improved traffic flow deferring the need for new road infrastructure.
- Transport infrastructure investment risk management of uncertainty due to disruptive change.

It is in relation to these focus areas that research will be undertaken, with new opportunities and resources sought both in terms of researchers and funds, in order to advance the knowledge base and forge new and innovative evidence-based solutions to support policy in effectively planning and managing Western Australia's future.

Towards the achievement of this three-year plan, key achievements envisaged in the **2023** Business Plan include:

- Commencement of seven core projects as part of the PATREC-iMOVE 2023-2025 core program of research
- Commencing three climate action-related projects
- Completing six core projects from the 2021-23 research program
- Completion of the three-year collaborative Australian Transport Research Cloud project with the Australian Urban Research Infrastructure Network (AURIN)
- Appointing a Programs Director
- Completing or substantially progressing nine external projects
- Pursuing National Collaborative Research Infrastructure Strategy funding (NCRIS) in partnership with AURIN to establish a WA research infrastructure node for climate action in transport and land use planning
- Organising the Australasian Transport Research Forum conference to be held in Perth 29 November – 1 December 2023.

Table of Contents

Executive Summary	1
Table of Contents	3
1. INTRODUCTION	5
1.1. Background.....	5
1.2. Purpose and structure	5
2. ACHIEVEMENTS IN BRIEF 2020-2022.....	5
3. VALUE PROPOSITION.....	6
4. STRATEGIC DRIVERS.....	9
5. RESEARCH PROGRAMS AND FOCUS AREAS.....	15
5.1. Established program of research	15
5.2. New program of research: Climate action in transport and land use planning	15
5.2.1. Background	15
5.2.2. Proposal.....	16
5.2.3. Board approval	18
5.2.4. Stage 1 actions and outcomes.....	18
6. CORE RESEARCH PROJECTS	20
6.1. Core projects – 2021-23 research program.....	20
6.2. Core projects – 2023-25 research program.....	20
6.3. Climate action projects.....	24
7. EXTERNAL PROJECTS.....	25
7.1. External project underway	25
7.2. External projects – new opportunities.....	25
8. KNOWLEDGE TRANSFER AND DISSEMINATION	27
8.1. Australasian Transport Research Forum (ATRF) conference.....	27
8.2. General research dissemination.....	27
8.3. Post-graduate researcher attraction	27
9. DELIVERING ON THE PLAN.....	28
9.1. Human resources	28
9.1.1. Core team contract extension.....	28
9.1.2. Appointment of Programs Director	28
9.1.3. Financial support.....	28
9.1.4. Wider team	28
9.2. Financial resources.....	31
9.3. Management and operations	32

9.3.1. PATREC Research Advisory Committee (PRAC) 32

9.3.2. Project selection process 33

9.3.3. Project management 34

9.3.4. Key Performance Indicators (KPIs) 35

9.4. Risks in delivering on the Plan 36

10. BUSINESS PLAN 2023 37

10.1. Background and purpose 37

10.2. Outputs achieved in relation to previous Plan (2022) 37

10.3. Core research project activity (2023) 37

10.4. Climate action program activities 38

10.5. External research project activity 2023 38

10.6. Communication activity 39

10.7. Human resource activities 39

10.8. Budget 2023 40

10.9. Key Performance Indicator Targets 2023 41

ANNEXURE A: PROJECT TECHNICAL REPORTS COMPLETED 2020-2022 42

1. INTRODUCTION

1.1. Background

The last PATREC Strategic Plan was produced for the period 2020-2022 including a more detailed Business Plan for the inner year, 2020. Subsequent Business Plans for 2021 and 2022 were produced, including any strategic updates where necessary.

The PATREC Research Advisory Committee (PRAC) together with a series of research project steering committees, has been instrumental in guiding the research direction presented in this Strategic Plan for the period 2023-2025, largely through the process of developing the 2023-25 core research program comprising seven priority research projects. These projects, all within the broad ambit of the still relevant research focus areas identified in the Strategic Plan 2017-2019, will commence in mid-2023 and will substantively be undertaken during 2024. Core projects which commenced in mid-2021 as part of the 2021-23 program of research will mostly continue through to completion in 2023.

The Strategic Plan for the period 2023-2025 incorporating a Business Plan for 2023, is presented to the PATREC Board at its last meeting of 2022, in accordance with the terms of the 2016 PATREC Collaborative Agreement.

1.2. Purpose and structure

The purpose of this Strategic Plan 2023-2025 (the Plan) is to set out the strategic direction of PATREC for the period, also providing a more detailed action-focussed Business Plan for the inner year, 2023. In line with the 2016 PATREC Collaborative Agreement, the Plan is revised every three years with any interim updates required, included as part of the annually prepared Business Plans.

This Plan has four parts. This introductory section, which provides the background to PATREC's current position and the purpose and process of developing the Plan, is followed by a summary of achievements under the 2020-2022 Strategic Plan and a restatement of the value proposition of PATREC which still remains valid. The third part presents the strategic direction with a three-year focus which sets out what PATREC will be doing, the context within which it is operating, resourcing allocations for delivery and Key Performance Indicators for measuring the success of delivery. The final part comprises the Business Plan which provides a more detailed view of goals, actions, deliverables, resourcing and a budget for the inner year of 2023.

2. ACHIEVEMENTS IN BRIEF 2020-2022

Guided by the last Strategic Business Plan 2020-2022, PATREC has successfully achieved outcomes across a range of performance areas, including:

- Research Projects (core and externally funded)
 - Completion of 22 substantial research project/sub-project technical reports – 11 core and 11 external (Annexure A); and
 - PATREC core research project package (seven projects) for 2023-2025 approved for commencement in mid-2023
- Attracting additional financial resources
 - \$3,185,306 of additional project funding sourced from non-subscription income i.e. external funding (2020 Annual Report, Table 10; 2021 Annual Report, Table 11; 1 December 2022 Board paper, Item 4, Table 4.2)
- Knowledge transfer and dissemination
 - 38 presentations made at PATREC and other connection events
 - Publication of 35 peer-reviewed academic papers (journal articles, book chapters, published peer-reviewed conference papers in proceedings)

- 11 post-graduate students attracted
- Satisfaction survey: 91% (2020), 92.3% (2021)

3. VALUE PROPOSITION

Within the broad contractual mandate of PATREC being constituted, as recently updated in the new agreement, “for the purposes of conducting collaborative, applied research and teaching in support of policy in the connected spaces of transport and land use planning”, the value proposition goes a step further by clarifying the value which is provided by PATREC to its constituent stakeholders beyond the sum of the individual parts. PATREC has two primary types of stakeholders: universities and government. Ultimately, the outputs sought by universities are primarily more and better academic papers, more external research funding, more postgraduate degrees, more collaboration and profile and more social impact. Government wants access to more, better and relevant evidence to inform plans and policy decisions.

The value-adding role of PATREC remains largely consistent with that presented in the Strategic Business Plan 2017-19 and can be stated as follows:

Capitalising on our extended [international] network of academic expertise and policy partners, our **value proposition** is to **broker and conduct** applied research and teaching in support of policy in the connected spaces of transport and land use planning in order to advance the knowledge base and forge new and innovative evidence-based solutions for effectively planning and managing Western Australia’s future. We do this through the following four key strategic activities:

1. multi-disciplinary, multi-institutional applied research in response to identified agency research requirements and knowledge gaps;
2. knowledge transfer through academic and less formal publications, connection events and a website as a reliable and accessible resource for researchers and policy-makers;
3. training, predominantly in the form of professional development through short courses, executive programs and “expert” courses on key topics, conducted in collaboration with other professional and industry bodies where possible; and
4. attracting additional research funds through business development.

The relative importance of each of these activity areas remains consistent with the priorities set in the Strategic Business Plan 2020-2022, with policy-responsive research and development remaining the highest priority for PATREC together with the associated and necessary business development, followed by knowledge management and transfer, with less resources allocated to education and training.

Proportional Value Contribution

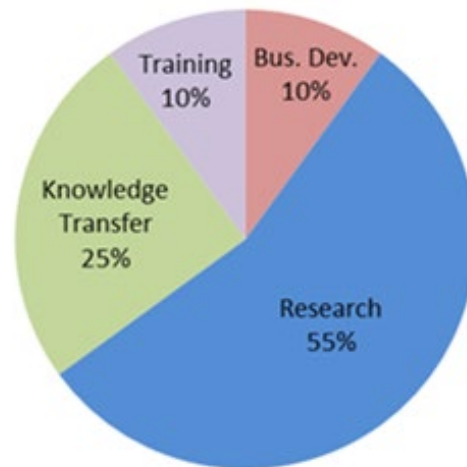


Figure 1: Key PATREC strategic activities and their relative importance

The value-add role of PATREC is further articulated in a set of strategic **objectives** relating to each of the **key strategic activities**:

Key Strategic Activity 1: Brokering and conducting multi-disciplinary, multi-institutional research in response to identified agency research requirements and knowledge gaps

- Identify, articulate, compile and communicate R&D needs of research users and knowledge gaps and opportunities as identified by research providers in the form of research focus areas and priorities.
- Initiate the translation of identified research needs and knowledge gaps into key research questions and project designs.
- Craft the research so as to achieving the R&D balance between more basic and applied research by pitching and designing the research in such a way as to deliver some shorter term, policy-responsive wins, but also enables publishable contribution to the knowledge base in the longer term.
- Coordinate, assemble and mobilise multi-disciplinary, multi-institutional research teams to propose and undertake research projects.
- Track and communicate current R&D activity to avoid duplication, identify knowledge gaps and collaborating opportunities.
- Contribute to the resourcing of R&D through:
 - Inspiring, attracting, acquiring and retaining human resource capacity by:
 - advertising and proactive search to discover potential human resource capacity
 - providing top-up scholarships for postgraduate studies, particularly PhDs
 - contributing to funding of postdoctoral fellowships
 - identifying and communicating available research capacity for optimal sharing of resources.
 - Undertaking core research including baseline studies as a platform on which to build more comprehensive research concepts to be undertaken by larger research teams funded by additional funding.
- Facilitate the establishment of new spin-off research entities if and when it is opportunistic and reasonable to do so.

Key Strategic Activity 2: Ensuring knowledge management and transfer through academic and less formal publications, connection events and an information portal as a reliable and accessible resource for researchers and policy-makers

- Require, produce and monitor the delivery of formal academic and less-formal publications as an essential research output in the form of:
 - Peer-reviewed technical working papers, overseen by an editorial board to ensure quality and published on-line
 - Factsheets on key findings for less academic audiences
 - Academic journal articles, books and book chapters.
- Require, produce and monitor the delivery of specific, practical policy products such as tools, methods and datasets, demonstrated and described.
- Initiate and conduct a range of targeted connection and communication events to inform and be informed of research and policy activities, products and findings in the form of:
 - Research Forums
 - Topic-specific conferences, seminars, workshops and breakfast functions, inviting national and international visiting experts as speakers when appropriate.
- Develop the website into more of a “Knowledge Portal” to disseminate relevant information:
 - Central resource for researchers and policy-makers, agencies (e.g. research supervisors, speakers)
 - One-stop-shop of who’s doing what
 - Facilitating integration with wider community of interest such as urban design and health
 - Data library/management of transport data.
- Raise the PATREC profile by publicising relevant research results.

Key Strategic Activity 3: Brokering the provision of training, predominantly in the form of professional development through short courses, executive programmes and “expert” courses on key topics, conducted in collaboration with other professional and industry bodies where possible

- Of highest priority, identify, initiate and coordinate short courses on topical issues, not too narrowly focussed on transport but also planning, infrastructure, freight, land use, which could be the precursor for formal units, with strong links with industry.
- Fund conversion of research outputs into short course material as a deliverable.
- Identify opportunities to contribute units to existing postgrad courses and undergrad to a lesser extent and coordinate, responsive to industry needs.

Key Strategic Activity 4: Attracting additional research funds through business development

- Replenish core funding through
 - “Brokering” fees on external research income earned
 - Short course fees
 - Affiliate sponsorship.
- Leverage external research funds by:
 - providing core funding to incubate new and innovative research ideas through to the development of project proposals including ARC grants
 - co-funding selected, high impact research projects.
- Identify opportunities, facilitating tendering for and conducting contract research.

4. STRATEGIC DRIVERS

Building on the achievements of the last three years in line with the direction set in the previous strategic plan (2020-22), but cognisant of an evolving contextual environment, this Strategic Plan 2023-2025 will guide the operations of PATREC and its research program during that period.

The main driver of the 2020-2022 strategic plan, WA government's program, presented in *Our Priorities – Sharing prosperity*, was "deferred indefinitely while the State Government focussed on its response to COVID-19" and is yet to be reactivated.

Climate change mitigation and adaptation and targeting net zero emissions, are dominating policy and research globally, nationally and in Western Australia. *Western Australian Climate Policy* released in late 2020, provides the focus and catalyst for climate adaptation and emissions reduction in WA. The policy is structured around six key themes, four of which relate to transport and land use planning - government leadership, lower-carbon transport, resilient cities and regions, and storing carbon and caring for our landscapes. It further highlights the need for stronger engagement with industry and research organisations to, inter alia, develop and support technology pathways for net zero emissions. This is the main driver for the new research program of climate action related to transport and land use planning, initiated by the Director General Transport in collaboration with the Chairman of the WA Planning Commission, and with the backing of the Chief Scientist.

Shaping Western Australia's low-carbon future (December 2021, Department of Water and Environmental Regulation), sets out the objectives of the sectoral emissions reduction strategies:

- To provide robust and credible emissions reduction pathways for Western Australia with tangible actions for reducing emissions consistent with the government's target of net zero emissions by 2050.
- To recognise the importance of significant action this decade to reduce emissions, transition emissions-intensive industries and protect Western Australia's economy from carbon transition risks.

Of relevance to PATREC, sectoral emissions reduction strategies will consider (amongst others):

- How the electrification of transport will impact electricity demand and the transition of the electricity grid
- Implications of the increasing global focus on supply chain emissions and demand for 'green exports'
- How to reduce emissions from waste, water and urban services
- How to reduce emissions from the built environment

(<https://www.wa.gov.au/system/files/2021-12/Shaping%20Western%20Australia%E2%80%99s%20low-carbon%20future.pdf>)

Further impetus to this climate action driver has been provided by the addition of a new research program to the iMOVE CRC's suite of existing programs which PATREC already contributes to:

Program 4: Sustainability, with the purpose of developing and delivering projects to:

- Understand what makes 'successful places' and how active transport fits into the landscape,
- Assess sustainable solutions for transport (bus, rail, freight).
- Identify what a low emission transport system would look like, including the impacts of reduced use of traditional fuels and the growth of sustainable alternatives.
- Examine the contribution that new modes (drones, bots) and new uses of existing modes could make to the future of transport.

- Develop policy and practice around equity and access, including accommodating disabled people in transport of the future and providing improved access to mobility for regional and remote communities.

More specifically, WA government drivers relating more specifically to transport and land use planning, come from newly published strategic documents.

The Department of Transport recently released *Strategic Intent 2022 – 2025* with the most relevant strategic priority being sustainable transport solutions, focusing on:

- Contemporary regulator modernising legislations and policies, utilising digital solutions and community-centred design
- Collaborate with industry and other government agencies to improve the alignment and consistency of state agency planning, infrastructure, and services
- Sustainable funding through long-term investment planning and asset management, and improved project and program evaluations to inform future planning and investment
- Transition towards net zero emissions
- Safe, fit for purpose emerging technology and future mobility modes
- Collaborate to lead and influence coordinated strategic transport planning and outcome

(https://www.transport.wa.gov.au/mediaFiles/about-us/ABOUT_P_Strategic_Intent_2022_25.pdf)

In the active transport space, the *Active Transport Infrastructure Policy (2021)* requires that WA Transport Portfolio agencies planning and undertaking major upgrades or network expansion works of State controlled assets will consider active transport infrastructure in the design and scope of works. The policy aims to ensure:

- Enhance legibility and connectivity with the existing and future active transport network for an integrated transport system, that works for all users;
- That infrastructure is suitable for people of all ages and abilities, including pedestrians, people with disabilities and those riding bicycles and other micromobility devices; and
- The provision of cycling infrastructure on routes identified within the Long Term Cycling Network (LTCN), on, alongside or across all highways, arterial roads, bridges and rail lines.

(https://www.transport.wa.gov.au/mediaFiles/active-transport/AT_P_ActiveTransportInfrastructurePolicyDec2021.pdf)

In the *Supplement to Active Transport Infrastructure Policy (May 2022)*, key objectives added, are to:

- Ensure that the planning and provision of new active transport infrastructure is integrated with other transport infrastructure projects;
- Support the delivery of the WA Bicycle Network Plan (WABN) and the Long Term Cycle Network (LTCN) (see Relationship to other transport strategies and plans below); and enable the delivery of a bicycle network that promotes travel choice and forms an integrated transport system for Perth and Western Australia (WA);
- Support the collaborative development and delivery of projects across the Portfolio and help to coordinate strategic priorities across transport modes; and
- Ensure the design and delivery of active transport infrastructure along State controlled roads and rail corridors is consistent and suitable for people of all ages and abilities including those riding bicycles and other micromobility devices, walking, and people with a disability.

(https://www.transport.wa.gov.au/mediaFiles/active-transport/AT_P_SupplementActiveTransportInfrastructurePolicy.pdf)

The Western Australian Planning Commission's *Strategic Plan 2022-25* (August 2022) includes a number of focus areas of relevance to PATREC research:

- Jobs and Infrastructure
 - Priorities
 - Support delivery of the State Infrastructure Strategy
 - Deliver a planning system and processes adapted for technological change in the community and economy
 - Support delivery of METRONET through the planning system as part of a whole-of-government approach
 - Outcomes
 - Alignment and integration of land use, infrastructure, and transport planning
- Liveable Communities
 - Priorities
 - Facilitate infill development and sustainable urban growth
 - Outcomes
 - Increased density and diversity around Activity Centres
 - Achieve infill housing and density targets and greater housing choice
 - Enable creation of liveable cities and towns with quality public and private spaces
- A Better Built Environment
 - Priorities
 - Lead precinct planning to enable METRONET
 - Outcomes
 - Improved design of urban centres, corridors and stations
 - Improved design quality of the built environment
- Environment and Natural Resources
 - Priorities
 - Continue the Coastal Management and Planning Program to deal with the risks posed by climate change
 - Outcomes
 - A planning system which addresses climate change
 - Planning to mitigate risks from natural hazards and events

(https://www.wa.gov.au/system/files/2022-10/WAPC_Strategic_Plan_2022-25.pdf)

Foundations for a Stronger Tomorrow, State Infrastructure Strategy (IWA, July 2022) has a number of core themes of relevance to PATREC:

- Managing demand for infrastructure through prevention, early intervention and pricing
- Improving the quality and consistency of strategic infrastructure planning and processes
- Addressing climate change
- Implementing data sharing and other tools to support infrastructure planning and investment decision making
- Optimising the existing infrastructure asset base
- Identifying major infrastructure projects and programs.

In the forward-looking section *Outlook – 2042*, a number of outcomes of relevance to PATREC are outlined:

- Transport
 - Technological advances in transport, through automated and semi-automated vehicles and zero emissions technology, lead to more productive supply chains, improved safety outcomes, cost savings and lower emissions.
 - Fully integrated planning and delivery results in more efficient and flexible connections between transport modes and stimulates and supports greater infill housing development, with a modal shift towards greater public transport use and active transport.
 - Ongoing targeted investment in freight networks, including in the Perth metropolitan area, supports efficient supply chains, international trade and export industries.
 - Improved technology, infrastructure planning and behavioural change lead to better transport system safety outcomes in line with the WA Government's vision for zero serious injuries and deaths on WA roads.
- Planning and coordination
 - A shared, long-term view of WA's public infrastructure needs is driving well-considered investment decisions and collaborative delivery.
 - Integrated regional plans are established, measured and routinely updated, aligning infrastructure needs with population change and economic development
 - Improved attractiveness and feasibility of urban intensification has resulted in well-located and well-designed infill development being the preferred outcome, with infill targets being met or exceeded.
- Climate change and sustainability
 - Aligned with growing global recognition of climate change, the state has progressed substantially towards its net zero emissions by 2050 target and has met or exceeded its interim targets by progressive transition to green energy and fuels, greater energy efficiency and offsetting residual emissions through carbon sequestration.
 - The public infrastructure program has undertaken a comprehensive transition to renewable energy use and the adoption of sustainable infrastructure design.
 - There is an ongoing focus across state agencies and GTEs to provide resilient infrastructure and services to adapt to and mitigate climate change impacts.
- Waste
 - WA has embraced a sustainable, low-waste circular economy that values waste, produces less waste, and reuses and recycles more for the benefit of the WA economy and environment. WA's waste targets are being met or exceeded.
 - Strong demand for recycled waste products is contributing to meeting waste targets for waste avoidance and recovery.
- Digital connectivity and technology
 - Government infrastructure assets are digitised, and a strong data analytics and visualisation capability informs planning and decision-making and results in significant cost savings.

Transport recommendations made include:

- Ensure investment in transport infrastructure delivers improved transport system outcomes by:
 - Further reforming governance arrangements for the Transport Portfolio to achieve an integrated, strategic, mode-agnostic approach to transport network planning and delivery across all modes of transport

- Reforming funding hypothecation legislative arrangements for motor vehicle licence revenue to fund the planning and delivery of priority projects across all transport modes, not only road-related infrastructure.
- Guide future transport infrastructure investments into areas of strategic need by
 - Refreshing statewide strategic transport planning, aligned with land-use plans and policies, including: a. developing, publishing and implementing a new 20-year regional transport plan, including a focus on freight supply chains across all modes and across all regions outside of Perth and Peel that builds on recent region-specific freight plans and considers strategic cross-regional issues
 - Developing, publishing and implementing a new 20-year Perth and Peel transport plan that combines and prioritises all key mode-specific transport planning across Transport Portfolio agencies and embeds a diverse range of non-build, demand management and transport innovation opportunities and scenarios, and station precinct intensification opportunities
 - Finalising development of the new Perth transport model, which incorporates the use of modern, diverse network usage data and establishes a seamless staffing and operational model for use across the Transport Portfolio
- Make better use of existing transport infrastructure, increase public transport usage and reduce road congestion by developing and implementing a public transport patronage action plan with a focus on non-build measures. The action plan should include:
 - Adopting behaviour-change initiatives, digital technologies, and operational and service delivery innovations, including targeted trials and mobility-as-a-service models and include these in the scope of future business cases for major road and rail infrastructure
 - Planning for better connectivity to educational facilities and other activity precincts.
- Progress targeted expansion and improvement of the road network by:
 - Delivering road safety programs in line with Driving change: Road Safety Strategy for Western Australia 2020–2030, including urban design innovations, speed reductions on local streets where appropriate and regional road safety treatments
 - Delivering regional maintenance and freight productivity programs to provide fit for purpose road networks
 - Progressing targeted, high-impact programs, including intersection upgrades, expanding the use of technology on arterial roads and trials for dynamic bus prioritisation
 - Progressing capacity and efficiency upgrades to freeways and major urban highways (particularly Mitchell and Kwinana freeways), incorporating all modes and greater use of technology as a priority option
 - Estimating impacts from a range of potential low and zero emissions vehicles and connected and automated vehicle rollout scenarios modelling and sensitivity testing in all major transport project business cases
- Plan and invest in the future development of new heavy rail infrastructure by:
 - Investing in improved station precinct accessibility through public and active transport programs and improving compliance with the Disability Discrimination Act 1992
 - Further investigating the merit and staging of investments in the Rail Growth Plan
 - Investigating the feasibility of these long-term major projects: East Wanneroo Rail Link, Bunbury Faster Rail and Perth metropolitan orbital rail route

- Provide certainty for future metropolitan planning by developing a business case for light rail and/or bus rapid transit as the next stage of major public transport priority investment in Perth, particularly in the Perth CBD and inner and middle suburbs, including completing a full options assessment comparing the Knowledge Arc light rail corridor against a potentially more extensive bus rapid transit system for Perth.
- Provide enhanced cycling and walking infrastructure by:
 - Allocating a greater portion of state funding to local government cycling projects that deliver strategic, continuous cross-suburban linkages, based on Perth Long Term Cycling Network priorities and equivalent regional plans, including higher state co-funding contributions, further CBD links, projects across multiple local government boundaries and safer active transport links to schools
 - Requiring application of new safe active transport infrastructure design guidelines for all state and local government projects, based on international best practice, including addressing the needs of micro-mobility device users, cyclists and pedestrians through relevant updates to the WA Planning Commission's policies and Main Roads WA's procedures for the design, review and approval of local government road works.
- Reduce the environmental impacts of road infrastructure use and achieve a higher uptake rate of low and zero emissions vehicles by implementing further measures that support the State Electric Vehicle Strategy for WA, including:
 - Setting a more ambitious target for the WA Government light vehicle fleet uptake
 - Accelerating the transition or conversion of other state government vehicles to low and zero emissions technologies, including specialised fleets of public transport buses and emergency services vehicles
 - Expanding the rollout of charging infrastructure on government land and buildings, including at train station car parks
 - Supporting the private sector to provide charging infrastructure, including in the Perth CBD through the Perth Parking Management Act 1999 and through planning system policy reforms.
- Support the introduction of connected and automated vehicles by ensuring the anticipated future road infrastructure and related technology system requirements of these vehicles are incorporated in the scope of future transport business cases and strategic planning.

In the WA Government Response to State infrastructure strategy - foundations for a stronger tomorrow (2023), most of the transport recommendations are fully or partially supported by government.

(<https://www.wa.gov.au/system/files/2023-02/FINAL%20WA%20Government%20Response%20to%20the%20State%20Infrastructure%20Strategy%20010223%20%281%29.pdf>)

Some of PATREC areas of interest are starting to impact road safety and have the potential to do so even more. *Driving change: Road Safety Strategy for Western Australia 2020–2030* (Road Safety Commission, November 2020) includes the priority areas of:

- Safe Road Users – Pedestrian, cyclists and others who are more vulnerable of roads; Children's road safety; motorcyclists
- Safe Roads – Regional and remote roads; intersections

(https://www.wa.gov.au/system/files/2021-07/Driving-Change-Road-Safety-Strategy-2020_2.pdf)

5. RESEARCH PROGRAMS AND FOCUS AREAS

5.1. Established program of research

PATREC's established program of research comprises five research focus areas in which to undertake research and deliver high-impact outcomes, although collaboration links and overlaps exist. These focus areas have evolved since their initial conceptualisation in the Strategic Plan 2013-16 in response to changing research needs and policy priorities (Figure 2, PATREC Strategic Plan 2017-2019). A new focus area was added in the previous strategic plan (2020 – 2022): Transport infrastructure investment risk management, in response to identified government priorities at that time. In relation to the new set of research needs identified by government partners to guide the 2023-25 core program of research, these focus areas remain relevant although no specific project needs in relation to infrastructure investment risk management were identified. The emerging technology focus area has been slightly broadened to accommodate identified research needs relating to road maintenance and safety outcomes. The changes are indicated in **bold** in Table 1. All focus areas are underpinned by an information and modelling platform, also supported by funding from external sources eg. Australian Urban Research Infrastructure Network (AURIN).

Table 1: Established program of research - research focus areas

Focus area	Description
Integrated land use and transport futures	Improving land use and transport integration now and into the future, using a systems-based, scenario-oriented, big data analytics approach to longer term strategic forecasting and evaluation, depending on and informing, integrated LU-T modelling
Smarter travel decisions	Focus on the potential for deployment and integration of technology to enable more intelligent and connected transport choices, helping Australian cities use resources more efficiently and deferring the need for new infrastructure
Integrated freight system optimisation	Planning intermodal and general logistics infrastructure for the future needs of Perth
Emerging technology for network optimisation and maintenance, safety and intelligence	Developing a data- and simulation-driven decision support systems for optimising road network operations and maintenance and improving road safety
Transport infrastructure investment risk management	Incorporating uncertainty in transport infrastructure planning and policy through adapting portfolio-wide strategic infrastructure investment planning and management tools, guidelines and frameworks to account for emerging risks

5.2. New program of research: Climate action in transport and land use planning

5.2.1. Background

The Western Australian Climate Policy released in late 2020 provides the focus and catalyst for climate adaptation and emissions reduction in WA. It is structured around six key themes, four of which relate to transport and land use planning - Government leadership, Lower-carbon transport, Resilient cities and regions, and Storing carbon and caring for our landscapes. It further highlights the need for

stronger engagement with industry and research organisations to, inter alia, develop and support technology pathways for net zero emissions.

Given the overlap of four of the six themes with planning and transport, the Director General Transport in collaboration with the Chairman of the WA Planning Commission, and with the backing of the Chief Scientist, initiated a proposal for a research program of climate action related to transport and land use planning, through PATREC (both the Director General and Chairman are PATREC Board members).

PATREC was considered an appropriate platform for delivering this new program, given its WA focus, demonstrated track record of governance arrangements ensuring delivery of policy-directed research and its cross-university collaboration, currently involving three of the four WA public universities. It is anticipated that the proposed planning and transport focussed climate action program will also provide an opportunity to demonstrate a successful model for a more substantial government-industry-research partnership towards net zero emissions. The Department of Water and Environmental Regulation, which coordinates the implementation of the Climate Policy, will be considering opportunities for such a program, in liaison with the Chief Scientist.

A climate action research program aligns with the strategic direction of all four WA public universities:

- One of UWA's two Grand Challenges driving teaching and research is solutions to Climate Change.
- Leveraging WA's distinctive geography to understand, harness, build and protect environments for sustaining people, place and planet is the aim of one of ECU's four research themes: Natural and Built Environments.
- Murdoch has three research and innovation focus areas, one of which is Sustainable Development and around which the Harry Butler Institute has been established as a research space where community, business and biodiversity can co-exist.
- Curtin has a focus on embedding sustainability principles and practices across research, learning and the student experience, operations, governance and leadership, guided by the UN Sustainable Development Goals.

5.2.2. Proposal

In late 2022, a proposal was presented to the Board to establish that a new program of research within the overarching PATREC mandate of conducting collaborative, applied research in support of policy in the connected spaces of transport and land. The new program of research: Climate Action in Transport and Land use Planning, would run in parallel, ultimately interacting, with the current PATREC research program. While the current PATREC program of research is framed around 5 interrelated focus areas, it is expected that the new program of research would develop its own set of focus areas to scope the research. For illustration purposes, these new focus areas could potentially relate to the relevant theme areas of the WA Climate Policy as indicated in Figure 3.

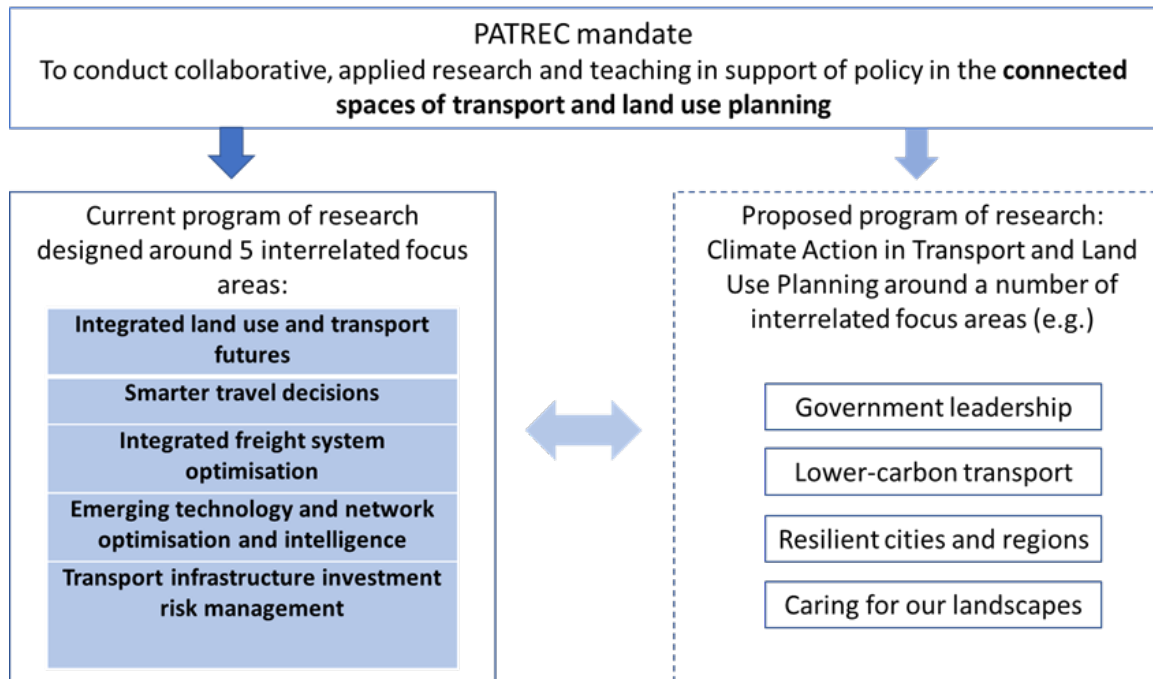


Figure 2: Proposed new program of research relating to Climate Action and its relationship with the current PATREC set-up

Establishing a new climate action program requires additional core funding and external project funding. It was proposed that the new program be established in two stages with associated budget implications:

Stage 1 (6 months from 1 July 2022)

- This stage would cost in the order of \$50,000 (funding for this stage would be provided by the government agencies).
- The funding would release some time of the Director to set up the Climate Action program by enabling the appointment of a business/ administrative support person covering finances and administration.
- This stage would also include recruitment of a new Programs Director for Climate Action program; identification of new sources of project funds; and scoping of 3-4 projects for commencement in 2023.

Stage 2 (from 1 January 2023)

- This stage would see the new research program implemented using the existing PATREC process for selecting core projects. Running the process for the new program in parallel to the process for selecting projects as part of the current core program of research for 2023-25, would see the new projects for the Climate Action program commencing from July 2023.
- It would cost in the order of \$500,000 per annum, being \$200,000 for administration and \$300,000 for new core project funds. This would effectively double the current core funding provided by government agencies and the universities.
- The funds for 'administration' would cover part of the costs for the Program Director (0.4FTE); the ongoing costs for the business/ administrative support resource; and some increased workload by the PATREC Chair in engaging with government and industry on the new program.

- To facilitate the appointment of a Programs Director, an initial 2-year fixed term offer is preferable and to enable an 18-24 project duration, it is proposed that an initial 2-year funding package be agreed.

In addition to the new core project funding of \$300,000 per annum, additional project funding would be leveraged from new and existing sources as is the case with current PATREC projects.

5.2.3. Board approval

The proposal was presented to the PATREC Board on 24 March 2022, where the Board:

- Endorsed the concept of a new Climate Action research program focussed on transport and land use planning;
- Supported the Stage 1 work to establish the new research program, noting that funding for this stage will be provided by the government agencies;
- Committed to seeking funding from their respective organisations for an initial period of two years from 1 January 2023, being a 100% increase in the current contributions; and
- Supported the Chair and Director engaging with Murdoch University to join PATREC as a core funding partner.

5.2.4. Stage 1 actions and outcomes

Administrative support

The Department of Transport contracted with UWA, providing \$50,000 to fund a senior administrative officer appointment for 6 months (0.6 FTE, July to December 2022) to provide additional support to the Director to release some time to focus on the establishment of the new program. A recruitment process was run and an appointment made, with commencement in mid-September 2022.

Core funding for an initial period of two years from 1 January 2023

Briefings were held with university and government agency partners to gauge the level of support and potential for the proposal to double current PATREC core funding to support the climate action program, as endorsed by the Board. Due to current financial constraints of universities and the expressed need for higher levels of return on investment, the proposed contribution from university partners was reduced. The Board Chair, PATREC Director and the Director: Portfolio Strategic Projects, briefed a Forum of the Deputy Vice Chancellors Research and Research Directors of the five WA universities.

Funding was committed as follows:

- Department of Transport \$166,000 over 2 years
- Main Roads WA \$248,000 over 2 years
- WA Planning Commission \$166,000 over 2 years
- UWA \$72,500 over 2 years
- Curtin University (in principle) \$72,500 over 2 years

Murdoch and ECU elected not to participate in the new program.

Scoping of 3-4 projects for commencement in 2023

- 3 project proposals under development (various stages):
 - Feasibility of battery-electric buses for regional school bus services (UWA; \$270,000; 14 months project; additional external funding secured from PTA, power companies and iMOVE CRC; agreement stage, planned commencement March 23)

- Mapping the Circular Economy of WA: Monitoring the contributions of circularity towards achieving Net Zero – Stage 1 (Curtin; \$300,000 – stage 1 of a potential \$500,000 project; 14 month project, draft proposal under revision, planned commencement April 23)
- Accounting for carbon in the planning for new residential suburbs (Australian Urban Design Research Centre (AUDRC), UWA with Murdoch; \$150,000; 14-month project, proposal under development, planned commencement April 23)

Recruitment of a new Programs Director to support the Climate Action program

A process to secure additional funding from key stakeholders to support these initial projects is underway and as soon as sufficient funds have been secured and contracting completed, recruitment of a new Program Director to support the Climate Action program will commence.

It was agreed at the Board meeting held on 1 December 2022 that the Programs Director could provide support across both PATREC programs (traditional and climate action) and in order to attract a suitable senior level candidate, an up to three-year fixed term contract could be offered, with the first two years funded from the additional core funding provided to support the climate action program, supplemented by business-as-usual core PATREC funding. The option of this position being hosted at Curtin was also supported by the Board.

6. CORE RESEARCH PROJECTS

6.1. Core projects – 2021-23 research program

Research will continue on projects which are part of the 21-23 program, all planned for completion in 2023:

- Transport Environment and Kids... 15 Years On
- Identifying opportunities to address transport disadvantage
- Freight network to support NW freight task
- Integrating AI and IoT based Bridge Health Monitoring
- Model of delay at traffic signals (Value Driver)
- ML models for road maintenance investment decision making

The last remaining core project of the 2019-21 research program: Enhanced vehicle detection at traffic signals and smart freeways, is yet to be concluded. Sensor deployment by Main Roads has been held up by significant delays in supply of materials due to COVID and global supply chain issues. Deployment of sensors is unlikely to be completed prior to 28/02/2023, in which case, the project would end in mid-2024.

6.2. Core projects – 2023-25 research program

The strategic direction of the first two years of the duration of this strategic plan has already largely been set in terms of the approval of a set of core funded research projects to commence in the second half of 2022. Through a process led by the PATREC Research Advisory Committee (PRAC), project ideas were submitted and prioritised by partner government agencies, agreed by the PRAC evaluation panel and circulated amongst partner universities. Interested researchers responded by means of concept proposals which were evaluated by government proposers with recommendations put forward for evaluation panel consideration and decision. The agreed projects were endorsed by the PRAC. Seven priority projects were approved by the Board to commence in mid-2023, continuing through to late 2024/early 2025.

Table 2: Approved Projects 2023-25

Title	Description
Automated intersection parameter measurement using aerial photography and computer vision - pilot	At the moment measuring of intersection design parameters for use in the model calibration and determining whether signal operations comply with policy and guidelines is largely a manual process, using aerial photography, as-built design, or concept design drawings. The parameters include number of lanes per approach, presence and length of pockets, channelisation treatments, turn radii, length of pedestrian crossings, median width and intersection crossing distance. This project aims to identify a method and develop a tool for using computer vision to automate the measurement of a list of intersection parameters from drone and fixed camera footage.

Evaluate the efficiency and economic benefit of spray injection pothole repair	The aim of this project is to find an efficient and more economical way of pothole repair, providing long lasting performance without failing quickly. The service life of MRWA repaired potholes is not that long. By the time some of the potholes have been repaired, the pavement is already compromised requiring expensive asphalt patches. Spray-injection pothole repair has been promoted in the industry for several years and considered to be the better method for fixing potholes. This project will evaluate the efficiency and economic benefits of the spray-injection pothole repair method against MRWA's current practices.
Evaluation of road safety treatments - road safety trial design and evaluation	Using video analytics and before-and-after studies, this research project aims to more quickly evaluate the effectiveness of a number of road safety treatments, including rumble strips, dragon's teeth line marking and vehicle activated signs. The treatments are expected to lower vehicle speeds and reduce crash risk, therefore saving lives and serious injuries on our roads. Without expeditious feedback on the impact of road safety treatments, their effectiveness is only understood after many years using crash statistics. This research seeks to understand the effectiveness of these treatments on regional roads and exit loops on freeways (5 - 6 locations/trial sites) by measuring vehicle trajectory, speed and acceleration/deceleration using video analytics. The significance of this research is that we can formally evaluate these treatments much earlier and understand their impact on vehicle speeds and trajectories. This allows for more certainty about their benefits, to understand where they may be appropriate and potentially deploy them at relevant locations much earlier than otherwise possible.
Impacts of e-rideables on the transport task in WA	This project aims to build and contribute to the newly growing body of evidence on how erideables, as a form of transport, have impacted and/or changed the transport task in WA, what this may look like into the future; and how the integration and operation of e-rideables can be improved. The objectives of the research are to: <ol style="list-style-type: none"> 1. Nuance the current e-rideable research being implemented by the Road Safety Commission which will provide insight into how e-rideables are being used and by whom - size and profile of the e-rideable community and how/whether this is changing; how e-rideables are being used (i.e., for what purpose and trips) and usage in relation to the legislation (i.e., levels of compliance). 2. Understand where e-rideables fit into the transport context, including where they are most beneficial or problematic. 3. Understand what policies, programs and/or infrastructure are required to support and guide their use in WA. 4. Understand the health benefits/dis-benefits associated with the use of e-rideables i.e., increasing or decreasing levels of physical activity. 5. Investigate the prevalence of incidents/injuries in terms of the relationship between e-rideables and other modes; and whether this is a function of context, rider behaviour and/or which other factors.
Micromobility and freight – exploring opportunities in WA	This project seeks to understand the potential of micromobility to assist with the last mile freight task, particularly in the Perth CBD. Opportunities for other major activity centres and regional centres in

	<p>WA will also be considered. Around the world, demand for deliveries continues to increase – from food delivery to Amazon parcels, people are buying more and more online, and wanting it delivered to their door as soon as possible. The resultant last mile freight task, the step that brings the product to the customer, adds pressure to the road network in built up areas, adds to pollution and noise issues, and has a negative impact on health, wellbeing and quality of place. This last mile is also the most expensive for operators, estimated to account for more than 50% of the overall delivery cost. Micromobility is being embraced as a smart option for the freight challenge in cities – including light weight vehicles such as (e)bikes, (e)cargo bikes, trolleys and drones. This research will consider the applicability and potential for micromobility to assist with the last mile freight task in the Perth CBD and other built-up areas and identify how this concept could be further progressed, if deemed viable. The research outcomes will inform the WA Active Mobility Strategy and/or the WA Freight Strategy (both in development) and associated implementation plans.</p>
<p>Transport mode choice development using PATHS data</p>	<p>The aim is to develop a tour-based mode choice model utilising 2018-2019 Perth Area Travel and Household Survey (PATHS) data and also Stated Preference (SP) survey data. This model could be implemented in any strategic transport model to reflect people’s travel behaviours in Perth and improve accuracy of estimating transport modes selection. The existing trip-based mode choice model used in STEM was developed based on the 2002-2006 PARTS data which is outdated. A new set of travel survey data (PATHS), collected during 2018-2020 before COVID-19, is now available, including the results of a SP survey for the first time. This set of travel behaviour data would be appropriate to develop a timely mode choice model. This model would reflect people recent travel behaviours and more accurately estimate travel mode choice in Perth. Moreover, it would also provide the insight of travel behaviour changes in mode choice. Accuracy and currency of travel behaviour estimation are critical to ensure the credibility of a transport model.</p>

<p>Designing a sustainable last kilometre freight and parcel delivery system for Perth and Peel</p>	<p>Planning Frameworks are primarily focused on freight movement between ports, primary industries and industrial areas. However, there is a need to consider the impact of increasing levels of last kilometre freight due to increased online purchases, in planning design guidance. The policy setting for urban development is also evolving to promote precinct design, transit-oriented development and higher density living. This is likely to change the way last kilometre freight and home deliveries move around the city and create an opportunity to improve sustainability through land use planning and design of the built environment. This research will address the following questions:</p> <p>Question 1: What does the last kilometre supply chain look like in Perth and Peel? Focussing on parcel delivery (online shopping), food and beverage (cafes restaurants, food delivery etc), retail (clothes, supermarkets, grocery home delivery services), and other commercial.</p> <p>Question 2: How will e-commerce, home delivery, new mobility modes and future design of the built environment change the last kilometre freight/delivery system in Perth and Peel? How sustainable is this new last kilometre freight and delivery system? Compared to other Australian Cities and/or similar sized cities internationally.</p> <p>Question 3: What should a well-designed system for last kilometre freight/delivery achieve? In the context of a local neighbourhood e.g. Streetscape, Urban Design and Crime Prevention Through Environmental Design (CPTED) principles; in the context of a regional network to cater to all users and service types?</p> <p>Question 4: How could Government promote a sustainable last kilometre freight/delivery system? Such as providing delivery stations (such as parcel lockers) at sites such as train stations and schools, including electric vehicle for freight, provision of charging facilities and co-location opportunities</p>
---	---

6.3. Climate action projects

Three climate action project proposals are under development with projects commencing in the first quarter of 2023 with durations of 14 to 18 months. At least one other project is likely to be initiated in 2023 and conclude in mid-2024. These projects will be funded from a combination of core, iMOVE and external funding.

Table 3: Climate action program projects commencing in 2023

Project	Description
<p>Feasibility of battery-electric buses for regional school bus services (DoT, PTA)</p> <p>UWA; \$270,000; 14-month project; additional external funding secured from PTA, power companies (pending) and iMOVE CRC (confirmed); agreement stage, planned commencement March 23</p>	<p>The State Government's Climate Policy (2020) sets out the strategic objectives for Western Australia to reach net zero greenhouse gas (GHG) emissions by 2050 and recognises the importance of significant action in the decade to 2030 to reduce emissions. As well, State Government agencies need to develop strategies to reduce GHG emissions by 80% on 2020 levels by 2030. The Public Transport Authority has taken responsibility for developing strategies to transition all government funded bus services to zero emissions in the next two decades. The transport sector generates nearly 15 million tonnes per annum of GHG emissions, and this has increased by 45% since 2005. The bus services funded by the State Government through the Public Transport Authority (Transperth, regional cities and towns, school bus services) require extensive fleets of buses and these typically involve a 15-20 year fleet replacement cycle. A Strategy to transition these bus services to zero emissions vehicles is needed to support decisions that will enable the transition to commence by the mid-late 2020s.</p> <p>The objectives of this research project are to assess the feasibility of battery-electric buses for regional school bus services in Western Australia; identify and, where needed, propose solutions for electricity network capacity constraints; and identify the technical support services required for zero emissions buses and related infrastructure.</p>
<p>Mapping the Circular Economy of WA: Monitoring the contributions of circularity towards achieving Net Zero (DOT, MRWA)</p> <p>Curtin; \$500,000; 18-month project, 2nd draft proposal under review, planned commencement April 23. This project is likely to commence with a Stage 1, \$300,000, comprising Phase 1 and part of Phase 2, while additional funding is secured</p>	<p>The purpose of this research project is to map and monitor the flow of materials from extraction to end-of-use and support the identification of key opportunities towards greater circularity and Net Zero emissions for Western Australian cities. The research will create tangible methods and tools for Western Australian cities to measure, monitor and report on enhanced material flows (including narrowing, slowing, cycling and regenerating) and assess progress towards decoupling raw material use and environmental impacts from economic activity and societal needs. Through local and state Government demonstrations, the project will inform resource strategies (including enhanced resource efficiency, closing supply chains, product lifetime extension, and residual waste management) and enable scale-up plans at the city and regional scale.</p> <p>Phase 1 - quantify the resource inflow and waste outflow linked to final consumption within Perth and Peel. These flows will also be linked to related energy use and greenhouse gas (GHG) emissions. These data will then be used to create a digital tool, WATCH (Western Australian Tool for Circular Horizons), to monitor trends and explore insights into cities' material and environmental footprint.</p> <p>Phase 2 - generate a map of material stocks and flows in Perth and Peel.</p> <p>Phase 3 - develop key performance indicators and a toolbox to explore a number of "what-if" type scenarios, identify hotspots and explore demand and supply-side solutions towards circular economy applications.</p>
<p>Accounting for carbon in the planning for new residential suburbs (WAPC)</p> <p>UWA AUDRC, Murdoch; \$150k, 14-</p>	<p>There is a priority need to understand how structure planning processes for new residential neighbourhoods can best contribute to reducing greenhouse gas emissions. This should consider how accounting for emissions can be accomplished at the planning stage and followed through to the implementation and delivery stages. There is a need to include a methodology for the assessment of planning intent, as well as more detailed consideration through construction, and operation.</p>

<p>month project, draft proposal under review, planned commencement March 23)</p>	<p>State Planning Policy (SPP 7.2) includes a requirement for precinct structure planning to consider greenhouse gas emissions reduction and incorporation of renewable energy sources, and the preparation of an Energy and Greenhouse Gas Emissions Statement. The Statement is to outline and demonstrate how the planning and proposed design of a precinct plan area reduces greenhouse gas emissions over Business as Usual approaches and incorporates renewable energy sources. This research will provide an evidence base and tools to support better decision making and assessment in planning and design of new neighbourhoods</p> <p>This project aims to:</p> <ul style="list-style-type: none"> • Examine how the design of new greenfield and urban infill areas can reduce carbon emissions and contribute to the creation of low or zero-carbon neighbourhoods • Identify the primary contributors to greenhouse gas emissions in neighbourhoods and how emissions can be reduced through planning and design • Determine how the modelling and reporting of emissions would occur at the structure plan stage and how these could be followed through to implementation • Establish key indicators and assessment methodology applicable at structure planning stage for new residential areas.
---	---

7. EXTERNAL PROJECTS

External projects are those which do not receive any PATREC core funds. External projects can be funded by PATREC collaborating partners by contributing additional funds (to subscription payments) and/or by other external funding agencies including the Commonwealth.

7.1. External project underway

External projects already secured/under negotiation for 2023-25 will be completed, including:

- AURIN – national transport domain specialist: Dr Sae Chi, \$98k); 1 February 22 to 31 June 2023
- Australian Transport Research Cloud (ATRC) - Accessibility tool (ADAPT) in Cloud (Lead: Sharon Biermann; Data Commons, AURIN, UWA, Curtin, 450k, 3 years, ends June 23)
- Improved Roundabout Modelling using Drone Video analytics (Lead: Chao Sun; iMOVE, MRWA, UWA, Aimsun) (\$392k)
- Innovation Connection (Metrocount) – Video analytics application (Lead: Chao Sun) (\$100k)
- AI-assisted Model Calibration for Real-time Traffic Simulation (Lead; Chao Sun; iMOVE, MRWA, Aimsun, UWA, \$400k)
- Optimising video analytics for traffic data collection and calibration incorporating fixed camera videos (Lead: Chao Sun; MRWA, iMOVE, UWA, \$200k)
- Freight route priority trial evaluation (Lead: Tele Tan; iMOVE, MRWA, Curtin, \$140k)
- Application of Biochar Waste in Pavement Design (Lead: Yuxia Hu; iMOVE, MRWA, UWA, \$200)
- Methodology advice and review for the Westport Supply Chain Integrated Design Modelling project (Deloitte Access Economics, invited review by - Chao Sun, Brett Smith, Doina Olaru, \$59k)

7.2. External projects – new opportunities

PATREC will continue to pursue external project opportunities, including:

- National Collaborative Research Infrastructure Strategy funding (NCRIS)

- For the past around 4 years, PATREC has been in discussions with AURIN (2 consecutive Directors) about establishing some sort of WA Node at PATREC with NCRIS fundings. AURIN is an NCRIS-funded facility.
- Notification received advising the two-stage process to apply for the “NCRIS 2022 grant opportunity” for NCRIS funding from 2023- 2028.
- Stage 1 (due 30 Nov 22) is for current recipients of NCRIS funding ie. AURIN to apply for “stability’ base operational funding.
- Stage 2 (early 2023) is for “additional” grant funding in line with the 2021 Roadmap, with the potential for PATREC to work with AURIN on a “WA Node”-type concept. The most feasible for us would be related to some sort of enabling platform for research into climate action in planning and transport - this could be all 4 WA universities as well as from my partner State government agencies aligning with the new PATREC research program
- New AURIN Director commenced 14 November 2022 and this opportunity has been raised with him for urgent discussion (Pascal Perez)
- ARC Industry Fellowship - Mid-career – application submitted for Chao Sun (with MRWA in-kind support and UWA cash): Evidence Based Road Design using Video Analytics Data (\$1 million, 4 years):
 - The project aims to facilitate timely feedback to road designers and modellers of behavioural responses of all road users to the application of a range of safety-enhancing road and road-side measures, under various local conditions and contexts and over time: by applying and advancing existing video analytics capabilities to before-after evaluation.
 - This project expects to generate an automated process for collecting and interpreting video data for use in before-after evaluation of the effectiveness of road safety measures, a systematised evidence base of behavioural responses of road users to a range of measures over time, accounting for local conditions, and a prototype agent-based model for safety evaluations; through integrating drone, machine learning, cloud computing, aerial photography and video technologies.
 - Expected outcomes of this project include improved before-after performance feedback to road designers, a repository of context-specific behavioural responses to inform design guidelines and modelling support for designers to assess designs prior to construction.
 - Significant benefits should be achieved including fewer injuries and deaths, Timely feedback to road designers and improved design guides will reduce the need for expensive retrofitting of roads and intersections prior to construction, health benefits due to more active travel due to focus on vulnerable users and industry enabled to use the outputs
- A further project idea: Trip generation rates for transport planning, was put forward as part of the call for core project ideas but was withdrawn on the basis that the resources needed to undertake the project to the required level of detail and accuracy required for subsequent use by government agencies, are beyond the PATREC core funding envelope. This project idea has been raised on previous occasions but never pursued further. It may be worthwhile to consider as an integrated transport and land use planning project opportunity separately from core funding. Two concept proposal were received prior to the project being withdrawn.

The intended aim of this research is to derive WA specific Trip Generation Rates for Transport Planning. The objective is to provide transport planners with a comprehensive tool that reflects the local WA traffic behaviour in mode choice and trip generation rates for various types of developments. DPLH and WAPC provide guidelines for traffic impact assessment for current and future development. These guidelines heavily refer to NSW trip generation rates

and those of the Institute of Transportation Engineers (ITE). Although this provides a guideline, it does not necessarily reflect the WA specific travel demand types/ trip generation rates.

There is a policy and guideline need for WA specific trip generation rates to properly assess the traffic impacts of developments in WA that is based on actual data analysis rather than depending on surveys from other states and countries. Similar to NSW, WA could start developing and adopting trip generation rates that reflects local travel demand, pattern, mode choice and trip distribution. Once developed this can be used by practitioners in the field of transport planning and development assessment. The WA specific trip generation rates will enable the proper assessment of the traffic impacts of developments in WA that is based on actual data analysis rather than depending on surveys from other states and countries.

8. KNOWLEDGE TRANSFER AND DISSEMINATION

8.1. Australasian Transport Research Forum (ATRF) conference

PATREC is playing a major role in organising the ATRF Conference to be held in Perth 29 Nov – 1 Dec 2023. It was last held in Perth ten years ago. The ATRF Conference is the biggest transport conference for researchers, government and consultants in AUS/NZ and is held annually with attendance levels of on average 150 delegates (<https://australasiantransportresearchforum.org.au/>). The 2023 proposed conference theme relates to climate action in transport. PATREC staff, Sae Chi and Charise Baker are the conference organisers and PATREC partners form the Local Organising Committee (LOC). The responsibility of the LOC is to provide advice on the key conference items (e.g. seeking keynote speakers, planning for special sessions during the conference such as site visits). The core LOC comprising key PATREC partners and close associates has been assembled, comprising:

- PATREC Director – Chair
- Steve Beyer (Transport Portfolio)
- Ryan Falconer (DoT)
- Jason Gordon (DPLH)
- Steve Atkinson (MRWA)
- Courtney Babb (Curtin)
- Sebastian Davies-Slate (WALGA)
- Andrew Cox (PTA)
- Kat O’Mara (ECU)
- Adri van der Mescht (Ipsos)
- Brett Smith and Doina Olaru (Scientific Committee)
- PATREC conference organisers – Sae Chi, supported by Charise Baker

8.2. General research dissemination

PATREC will continue to present research project results and outcomes at project dissemination seminars, conferences and other events. While the primary outputs of PATREC research is technical reports, publication in academic journals continues to be encouraged as a requirement from university partners.

8.3. Post-graduate researcher attraction

Building on progress made in 2022 with two Masters Practicum students graduated, one PhD thesis submitted, six continuing PHD and Masters and one new PhD commencing, PATREC will continue to

identify opportunities to increase the number of post-graduates attracted including offering a selected few top-up scholarships of around \$10,000/annum each.

9. DELIVERING ON THE PLAN

9.1. Human resources

9.1.1. Core team contract extension

- Senior Administrative Officer appointed – after interviewing four potential candidates, Charise Baker was offered the position and accepted, commenced in mid-September 2022, for 6 months, 0.6FTE, initially, funded by a special climate action, once-off grant from DoT but budgeted for continuation using PATREC core funding.
- Dr Chao Sun's fixed term contract extended for 2-years
- Dr Sae Chi's fixed term contract extended for 1-year
- Tristan Reed's contract extended for 1 year
- UWA's financial services support to PATREC

9.1.2. Appointment of Programs Director

The recruitment of a PATREC Programs Director to provide additional capacity in leading and managing PATREC projects across both the current program as well as the new climate action program can commence as soon as the new climate action program core funding has been contracted. To improve the distribution of core funding amongst core university partners, there is potential to consider making this appointment through Curtin. There are some operational challenges but this could also be a structural change which could contribute to building stronger collaborations between UWA and Curtin, including drawing in Urban Planning expertise to strengthen PATREC's land use research capability to supporting WAPC and DPLH, in the climate action as well as the more traditional PATREC program of research. A 3-year fixed term contract would be preferable to attract high quality applications with 2-years being funded from the Climate action program and a year from PATREC core funding.

9.1.3. Financial support

- A Management Accountant has been designated to provide PATREC support and has developed a prototype spreadsheet tool for more streamlined and automated extraction of financial information from PeopleSoft directly into the format required for management of PATREC finances including a standardised Board paper template - undergoing testing for implementation in 2023
- Contracts, budgets and timesheet approvals being managed by Charise Baker
- Process for salary allocations to project grants revised and streamlined

9.1.4. Wider team

With leadership, administration and coordination by a small PATREC core team, a much wider team of PATREC project research associates from across the partner universities and with some support from adjuncts, consultants and PhD students, are called upon to conduct policy-informing, applied research. Through the mechanism of project steering committees, researchers are supported and enabled by a dedicated team of agency stakeholders who ensure that the research is well-aligned with policy objectives and that the research outcomes are well-communicated within the agencies and wider if required.

Table 4: Research team

Sharon Biermann	PATREC office - Director (0.4 FTE)
Charise Baker	PATREC office - Senior Administrative Officer (0.6 FTE)
Sharon Biermann	Research - Director – 0.6 FTE
<i>New position</i>	<i>PATREC Programs Director</i>
Yuchao Sun	PATREC Senior Research Fellow (traffic engineering); 1.0 FTE
Sae Chi	PATREC Research Fellow (transport economics); 1.0 FTE
Tristan Reed	PATREC Research Fellow (spatial analytics), Curtin (0.8 FTE)
Sergio Matias	PATREC Research Assistant (1.0 FTE)
Nicholas Pritchard	PATREC Research Assistant (part time)
Demiris Daniel	PATREC Research Assistant (part time)
Liam Cummins	PATREC Research Assistant (part time)
Tom Lymburn	PATREC Research Assistant (part time)
Max Davidson	PATREC Research Assistant (part time)
Samson Ting	PATREC PhD scholarship, research assistant (part time)
Finn Edgar	PATREC Research Assistant (part time)
Padraig Lamont	PATREC Research Assistant (part time)
Doina Olaru	Research Associate, UWA Business School
Kirsten Martinus	Research Associate, UWA Geography
Brett Smith	Research Associate, UWA Business School
Julie Lee	Research Associate, UWA Business School
Thomas Stemler	Research Associate, UWA Mathematics
Michael Small	Research Associate, UWA Mathematics and Statistics
Shannon Dee Algar	Research Associate, UWA Forrest Prospect Fellow, Maths and Statistics
Atif Mansoor	Research Associate, UWA Computer Science and Software Engineering
Robert Lee	Research Assistant, UWA Computer Science and Software Engineering
Mark Reynolds	Research Associate, UWA Physics, Mathematics, Computing
Farid Boussaid	Research Associate, UWA Electrical, Electronic & Computer Engineering
Mohammed Bennamoun	Research Associate, UWA Electrical, Electronic & Computer Engineering
Yuxia Hu	Research Associate, UWA Civil, Environmental and Mining Engineering
Colin leek	Research Associate, UWA Civil, Environmental and Mining Engineering
Lynn Meuleners	Research Associate, WA Centre for Road Safety Research, UWA
Teresa Senserrick	Research Associate, WA Centre for Road Safety Research, UWA
Paul Roberts	Research Associate, WA Centre for Road Safety Research, UWA
Matthew Albrechts	Research Associate, WA Centre for Road Safety Research, UWA
Laura Fruhen	Research Associate, School of Psychological Science, UWA
Gina Trapp	Research Associate, Telethon Kids, UWA
Anna Gannett	Research Assistant and PhD candidate, Population and Global Health, UWA
Paula Hooper	Research Associate, AUDRC, UWA
Julian Bolleter	Research Associate, AUDRC, UWA
Bill Grace	Research Associate, Adjunct, AUDRC, UWA
Chris Lund	Research Associate, Adjunct, AUDRC, UWA

Thomas Braunl	Research Associate, Electrical, Electronic and Computer Engineering, UWA
David Harries	Adjunct Associate, Electrical, Electronic and Computer Engineering, UWA
Mark McHenry	Adjunct Research Associate, Murdoch University
Guido Wager	Research Associate, Electrical, Electronic and Computer Engineering UWA
Julie Saunders	Research Associate, Population and Global Health, UWA
Tele Tan	Research Associate, Electrical Engineering, Computing and Mathematical Sciences, Curtin
Jun Li	Research Associate, Civil and Mechanical Engineering, Curtin
Wensu Chen	Research Associate, Civil and Mechanical Engineering, Curtin
Zhen Peng	Research Assistant, Civil and Mechanical Engineering, Curtin
Ritu Gupta	Research Associate, Electrical Engineering, Computing and Mathematical Sciences, Curtin
Himanshu Agrawal	Research Associate, Electrical Engineering, Computing and Mathematical Sciences, Curtin
Carey Curtis	Research Associate, Adjunct, UWA
Courtney Babb	Research Associate, Urban Planning, Curtin
Dora Marinova	Research Associate, CUSP, Curtin
Josh Hopkins	Research Associate, CUSP, Curtin
Roberto Minunno	Research Associate, CUSP, Curtin
David McMeekin	Research Associate, Electrical Engineering, Computing and Mathematical Sciences, Curtin
Kerry Brown	Research Associate, Employment and Industry, Business and Law ECU
Tony Marceddo	Research Associate, Securing Digital Futures, ECU
Flavio Macau	Research Associate, Employment and Industry, Business and Law ECU
Navjot Bhullar	Research Associate, Psychology, ECU
Shihao Yan	Research Associate, Science, ECU
Kat O'Mara	Research Associate, Science, ECU
Reza Kiani Mavi	Research Associate, Supply Chain and Project Management, Business and Law, ECU
Ferry Jie	Research Associate, Supply Chain and Logistics Management, Business and Law, ECU
Hadrian Djajadikerta	Research Associate, Strategic Management Accounting, Business and Law, ECU
Zhaoyong Zhang	Research Associate, Finance and Economics, Business and Law, ECU
Mohammad Iranmanesh	Research Associate, Vice-Chancellor's Research Fellow, Business and Law, ECU

Table 5: Core Project government partner steering committee participation

Mark Woods	DoT	Graham Jacoby	MRWA
Matt West	DoT	Lalinda Karunaratne	MRWA
Michelle Moyo	DoT	Miaad Khayatian	MRWA
Fabrice Gregoire	DoT	Pettitt Kingsley	MRWA
Sharif Siddique	DoT	Qindong Li	MRWA
Renlong Han	DoT	Cory Ross	MRWA

Liam	Heitson	DoT	Chris	Scholte	MRWA
David	Wake	DoT	Raj	Shah	MRWA
Ryan	Falconer	DoT	Wes	Soet	MRWA
Leonie	Gibbons	DoT	Craig	Wooldridge	MRWA
Michelle	Prior	DoT	Steve	Howells	MRWA
Liza	Picton	DoT	Colin	de Costa	MRWA
Claire	Thompson	DoT	Scott	Fennelly	MRWA
Susie	Page	DoT	Flori	Mihai	MRWA
John	Chortis	DPLH	Tim	Keane	MRWA
Damien	Martin	DPLH	Rachel	Manning	MRWA
Lisa	Powell	DPLH	Adrian	Bonner	MRWA
Jason	Gordon	DPLH	Jaqueline	De Oliveira Haupt	MRWA
Daniel	Bromley	DPLH	Christopher	Skantzios	MRWA
Melinda	Payne	DPLH	Hector	Lee	MRWA
Steve	Atkinson	MRWA	Viet	Vu	MRWA
Rafael	Carvajal Cifuentes	MRWA	Wei	Khoo	MRWA
Les	Marchant	MRWA	Flori	Mihai	MRWA
Raquib	Hossain	MRWA	Ash	Radhakirshnan	MRWA

9.2. Financial resources

Climate action program-related budget items have been included separately to enable distinguishing from business-as-usual items. Business-as-usual core subscriptions include CPI increases. To date, 2023 and 2024 core contributions have been secured while the variation agreement to extend PATREC for a further period to December 2025 is in process. iMOVE CRC income is core project income and remains fixed per annum in accordance with initial participant commitments. External research research grants and contracts refers to all income from non-core funding sources including additional funding from partners and non-partners (eg. AURIN), UWA iMOVE participation funds which are used for university co-contribution for external projects involving UWA, additional funds from Curtin when they are involved in iMOVE projects. ECU participant funding is not included here as it is paid directly to iMOVE CRC and does not flow through the PATREC accounts (only a nominal \$5K/annum).

Climate action income comprises core government (\$83k/annum each from DPLH and DOT and \$124k/annum from MRWA) and core university (\$36,250/annum from Curtin and UWA) – both secured for 2023-24 and assumed the same for 2025. Climate action external income comprises additional from PATREC partners, PTA, power companies, EMRC etc and iMOVE.

Total annual income is budgeted at between \$2,2 million - \$2,5 million per annum.

PATREC office expenditure is kept low at around \$300k per annum, with most costs incurred on research projects. The costs of the new Programs Director, as is the case of the Director costs, have been split between PATREC office (0.4FTE) and research (0.6FTE).

PATREC research fellow costs are \$40k higher in 2023 due the agreed funding of a portion of time for ATRF conference organisation.

Total expenditure per annum is slightly higher than income but the expected carry over from 2022 due to delayed expenditure will result in positive annual balances in the order of \$40k - \$150k.

Table 6: Three-year budget estimate (2023-2025)

PATREC Income and Expenditure 2023-25	Budget 2023	Budget 2024	Budget 2025
INCOME			
WA Government Grants (core subscriptions)	292,202	300,968	322,938
Universities Sponsorship (core subscriptions)	210,803	217,127	232,977
iMOVE/PATREC core projects	370,000	370,000	370,000
External Research Grants & Contracts	900,000	950,000	970,000
Climate action (WA gov core)	290,000	290,000	290,000
Climate action (WA uni core)	72,500	72,500	100,000
Climate action external income	100,000	185,000	250,000
Accrued Interest	0.00	0	0
Total Income	2,235,504	2,385,594	2,535,915
EXPENDITURE			
PATREC OFFICE	288,588	298,327	310,805
Director (0.4)	102,805	104,092	105,886
Programs Director (0.4)	80,292	84,244	88,707
Administrative support (0.6)	72,562	76,223	80,345
General Office Costs	5,000	5,000	5,000
Board Chair Stipend	27,929	28,767	30,867
RESEARCH PROJECTS	2,174,646	2,192,505	2,201,889
Research Co-ordination (Dir. 0.6)	154,207	156,139	158,829
Research Co-ordination (Programs Dir.0.6)	120,439	126,367	133,060
iMOVE participation & add. Project contrib.	550,000	550,000	550,000
PATREC Research Fellows	450,000	410,000	410,000
Researcher Assistants, Services, Expenses	650,000	650,000	650,000
Climate action researchers, services, expenses	250,000	300,000	300,000
Total Expenditure	2,463,234	2,490,832	2,512,694
YTD BALANCE	-227,730	-105,237	23,221
Balance Brought Forward	376,828	149,098	43,861
CLOSING BALANCE (incl Balance B/F)	149,098	43,861	67,082

9.3. Management and operations

9.3.1. PATREC Research Advisory Committee (PRAC)

The PRAC will continue to be the vehicle for strengthening coordination amongst the PATREC partners in relation to the identification, planning, prioritisation, conducting, progress monitoring and promotion of core funded applied research projects. The objectives as encapsulated in the Terms of Reference are to:

- maintain an element of formality and rigour to the research project identification, selection, support, monitoring and dissemination process;

- enhance communication amongst partners; and
- advise the Board on project level matters, allowing the Board to focus on strategic matters.

Further, PRAC members will continue to support the Director in the activities of research project planning, execution and progress monitoring and communication.

The PRAC will continue to meet three times a year, each time two weeks in advance of a Board meeting. More frequent interim meetings may also be held to ensure continuity in communication.

Current members are indicated in Table 4. Membership is reviewed and approved by the Board annually.

Table 7: Approved PRAC members for 2022/23

2022/23	Organisation
Steve Atkinson (Chair)	Main Roads WA
Vicki McAllister	Department of Transport
Ryan Falconer (Deputy)	Department of Transport
Cory Ross	Main Roads WA
Damien Martin	Department of Planning, Land & Heritage
John Chortis	Department of Planning, Land & Heritage
Martin White	Public Transport Authority
Tele Tan	Curtin University, Electrical Engineering, Computing and Mathematical Sciences
Courtney Babb	Curtin University, Design and Built Environment
Hadrian Djajadikerta/Ferry Jie	Edith Cowan University, Natural & Built Environment theme
Tony Marceddo	Edith Cowan University, Securing Digital Futures theme
Doina Olaru	UWA Business School
Brett Smith	UWA Business School
Sebastian Davies-Slate	WA Local Government Association (WALGA)

9.3.2. Project selection process

The project approval process established in relation to the PRAC advising the Board, will be continued for projects which are funded wholly or in part by PATREC core funds, taken to the PRAC and Board for approval (Table 6). A formal project selection process is conducted every second year, commencing in July, to inform the annual Business Plan to be presented to the Board at its last meeting of the year. The process has been amended to include a pitch session in October for government proposers to explain their project ideas to researchers and respond to questions as well as to provide an opportunity to identify potential collaboration opportunities amongst researchers.

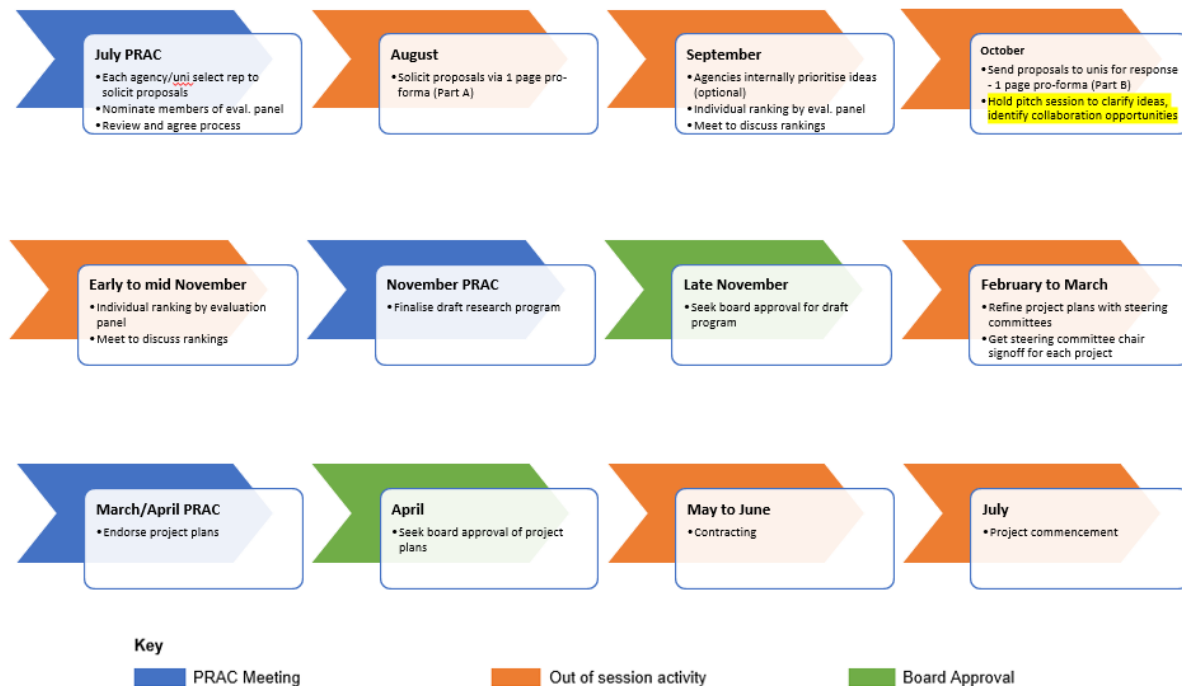


Figure 3: Formal core project selection process (every two years)

Although the formal project selection process conducted annually as outlined in Table 6 has the advantage of predictability, it is not sufficiently flexible to encourage responsiveness to new ideas and agile adoption of opportunities as they emerge. Therefore, in addition to the formalised annual process, unsolicited short project proposals/EOI will be accepted at any time of the year after which the same process will be followed as outlined in Table 8 but not the set dates. Rather, the EOI will be taken to the next PRAC meeting to start the process, whenever that may be. Both PRAC and the Board would have as a standing agenda item “Consideration of any submitted proposals”.

The selection criteria to be applied in the case of both solicited and unsolicited projects are as follows:

- Alignment with the Strategic Plan
- Policy relevance
- Fit with the current portfolio of PATREC activities
- Contribution to PATREC KPIs
- Level of co-contribution from funding sources (either PATREC partner or external)
- End-user pull
- Steering Committee endorsement
- Balance of researcher and of end-user engagements, commensurate with their respective inputs
- No duplication of research or what has already been done within agencies

9.3.3. Project management

Once projects are underway, Leaders will report three times a year on progress against milestones to PRAC and the Board. The reporting requirements will not be onerous but will be sufficient to enable the Director and PRAC to identify whether the project is on track or if there are issues requiring attention. A reporting template comprising 3-4 questions on progress will be provided and the need for quarterly reporting will be included as a requirement in the project plan or contract.

9.3.4. Key Performance Indicators (KPIs)

The PATREC Review recommended that fewer KPI’s be set and that more qualitative indicators be included. At the August 2016 Board meeting, the introduction of a short, on-line stakeholder satisfaction survey was agreed to in addition to a shortened list of indicators, presented initially in the 2016 Business Plan (Table 7). Since then, the survey is conducted annually in January/February to determine the satisfaction level of the previous year and the results reported in the Annual Report.

Table 8: Key Performance Indicators

Key Performance Indicators	
<i>Academic Performance Indicators</i>	
Number of journal papers published	
Number of peer-reviewed book chapters published	
Number of peer-reviewed conference papers published in proceedings	
Number of peer-reviewed books published	
Number of PhD candidates attracted and graduated	
Value (\$) of [direct] external research funding secured (through PATREC account)	
<i>Policy Impact Performance Indicators</i>	
Number of high impact, policy-informing projects/sub-projects completed	
Number of substantive Technical Reports/Working Papers accepted/published	
Number of PATREC Perspectives/iMOVE news articles published on PATREC website	
Number of presentations at PATREC and other connection events	
Number of connection events arranged and held	
Number of short courses, unit contributions presented	
<i>Stakeholder (academic and policy) satisfaction indicator (qualitative)</i>	
1	PATREC research outcomes are useful for my work needs
2	In general communications between PATREC researchers and industry partners are good
3	The research results provided by PATREC activities will provide value for money
4	PATREC partners and researchers understand each other’s needs
5	Working with PATREC partners allows academics to undertake innovative research
6	I expect greater interaction between PATREC partners and researchers
7	Overall I am satisfied with my work with PATREC

9.4. Risks in delivering on the Plan

The major risks identified in delivering on the plan are:

- Human resource availability;
- Human resource capability;
- Designing and implementing a viable financial model to ensure sustainable funding flows back into PATREC; and
- Maintaining active engagement of industry partners.

10. BUSINESS PLAN 2023

10.1. Background and purpose

According to the 2016 Collaborative Agreement, Business Plans will be presented to the Board at the last meeting of each calendar year to direct business for the following year. For the years when Strategic Plans are due, the Business Plan for the first year is included in the Strategic Plan.

The purpose of this Business Plan 2023 is to:

- outline the research project program for 2023;
- provide a working budget for 2023;
- outline the human resources plan for 2023; and
- set key performance indicator targets.

10.2. Outputs achieved in relation to previous Plan (2022)

Key outputs for 2022:

- Seven core projects selected to form part of 2023-25 program
- Three significant iMOVE projects (external) completed (Appendix A)
 - Working from Home – changes in transport demand – Perth, comprising 7 technical reports
 - Smart Transport Technology Roadmap
 - Modelling perimeter controls based on macroscopic fundamental diagrams
- 2 external projects completed:
 - Air Health Monitor – Review
 - Application of video analytics on Principal Shared Paths
- 9 journal paper published, exceeding target
- 16 presentations made at PATREC and other connection events
- ARC Mid-career Industry Fellowship grant application submitted - Chao Sun (with MRWA in-kind support and UWA cash): Evidence Based Road Design using Video Analytics Data (\$1 million, 4 years)
- Climate action in transport and land use planning – program establishment
- 2023 Australasian Transport Research Forum conference in Perth 29 Nov – 1 Dec 2023 – planning commenced

10.3. Core research project activity (2023)

Substantially complete core projects from 2019-21 and 2021-23 core research programs:

- Transport disadvantage
- Model for estimating delays at traffic signals
- ML for road maintenance decisions
- Bridge Health Monitoring
- Transport and Kids – 15 years on
- Freight network to support NW freight task
- Enhanced Vehicle Detection (2019-21)

Commenced projects from new 2023-25 core research program:

- Automated intersection parameter measurement using aerial photography and computer vision - pilot
- Evaluate the efficiency and economic benefit of spray injection pothole repair
- Evaluation of road safety treatments - road safety trial design and evaluation

- Impacts of e-rideables on the transport task in WA
- Micromobility and freight – exploring opportunities in WA
- Transport mode choice development using PATHS data
- Designing a sustainable last kilometre freight and parcel delivery system for Perth and Peel

10.4. Climate action program activities

Building on the initial establishment steps taken in 2022, the primary activities in 2023 will include:

- Developing a strategic plan for the climate action program
- Securing external funding to support the program
- Commencing and substantially progressing the three initial projects and identifying further projects
- Establishing processes and governance arrangements in relation to current PATREC program

10.5. External research project activity 2023

External projects already secured/under negotiation for 2023-25 will be completed or progressed, including:

- AURIN – national transport domain specialist: Dr Sae Chi, \$98k; 1 February 22 to 31 June 2023
- Australian Transport Research Cloud (ATRC) - Accessibility tool (ADAPT) in Cloud (Lead: Sharon Biermann; Data Commons, AURIN, UWA, Curtin, 450k, 3 years, ends June 23)
- Improved Roundabout Modelling using Drone Video analytics (Lead: Chao Sun; iMOVE, MRWA, UWA, Aimsun) (\$392k)
- Innovation Connection (Metrocount) – Video analytics application (Lead: Chao Sun) (\$100k)
- AI-assisted Model Calibration for Real-time Traffic Simulation (Lead; Chao Sun; iMOVE, MRWA, Aimsun, UWA, \$400k)
- Optimising video analytics for traffic data collection and calibration incorporating fixed camera videos (Lead: Chao Sun; MRWA, iMOVE, UWA, \$200k)
- Freight route priority trial evaluation (Lead: Tele Tan; iMOVE, MRWA, Curtin, \$140k)
- Application of Biochar Waste in Pavement Design (Lead: Yuxia Hu; iMOVE, MRWA, UWA, \$200)
- Methodology advice and review for the Westport Supply Chain Integrated Design Modelling project (Deloitte Access Economics, invited review by - Chao Sun, Brett Smith, Doina Olaru, \$59k)

PATREC will continue to pursue external project opportunities ie. those projects which do not receive any PATREC core funds. External projects can be funded by PATREC collaborating partners by contributing additional funds (to subscription payments) and/or by other external funding agencies including the Commonwealth.

The primary opportunity to be pursued is the National Collaborative Research Infrastructure Strategy funding (NCRIS):

- For the past around 4 years, PATREC has been in discussions with AURIN (2 consecutive Directors) about establishing some sort of WA Node at PATREC with NCRIS fundings. AURIN is an NCRIS-funded facility.
- Notification received advising the two-stage process to apply for the “NCRIS 2022 grant opportunity” for NCRIS funding from 2023- 2028.
- Stage 1 (due 30 Nov 22) is for current recipients of NCRIS funding ie. AURIN to apply for “stability’ base operational funding.
- Stage 2 (early 2023) is for “additional” grant funding in line with the 2021 Roadmap, with the potential for PATREC to work with AURIN on a “WA Node”-type concept. The most feasible

for us would be related to some sort of enabling platform for research into climate action in planning and transport - this could be all 4 WA universities as well as from my partner State government agencies aligning with the new PATREC research program

- New AURIN Director commenced 14 November 2022 and this opportunity has been raised with him for urgent discussion (Pascal Perez)

10.6. Communication activity

PATREC will play a significant role in the organising of the Australasian Transport Research Forum conference to be held in Perth 29 Nov – 1 Dec 2023. The Director will chair the local organising committee (LOC), PATREC partners and associates will comprise the core LOC and PATREC research fellow, Sae Chi will play a lead organising role, supported by PATREC senior administrative officer, Charise Baker. Doina Olaru and Brett Smith comprise the scientific committee.

10.7. Human resource activities

In addition to the usual project-specific casual and fixed term appointments and renewals, a key HR activity will be the recruitment of a PATREC Programs Director to provide additional capacity in leading and managing PATREC projects across both the current program as well as the new climate action program can commence as soon as the new climate action program core funding has been contracted. To improve the distribution of core funding amongst core university partners, there is potential to consider making this appointment through Curtin. There are some operational challenges but this could also be a structural change which could contribute to building stronger collaborations between UWA and Curtin, including drawing in Urban Planning expertise to strengthen PATREC's land use research capability to supporting WAPC and DPLH, in the climate action as well as the more traditional PATREC program of research. A 3-year fixed term contract would be preferable to attract high quality applications with 2-years being funded from the climate action program and a year from PATREC core funding. This option is included in the budget as part of the Strategic Plan 2023-25.

10.8. Budget 2023

Increased subscription payment for 2023 as per signed variation agreement have been included in the budget as well as the new climate action program (Table 9).

Table 9: Budget 2023

PATREC Income and Expenditure 2023	Budget 2023
INCOME	
WA Government Grants (core subscriptions)	292,202
Universities Sponsorship (core subscriptions)	210,803
iMOVE/PATREC core projects	370,000
External Research Grants & Contracts	900,000
Climate action (WA gov core)	290,000
Climate action (WA uni core)	72,500
Climate action external income	100,000
Accrued Interest	0.00
Total Income	2,235,504
EXPENDITURE	
PATREC OFFICE	288,588
Director (0.4)	102,805
Programs Director (0.4)	80,292
Administrative support (0.6)	72,562
General Office Costs	5,000
Board Chair Stipend	27,929
RESEARCH PROJECTS	2,174,646
Research Co-ordination (Dir. 0.6)	154,207
Research Co-ordination (Programs Dir.0.6)	120,439
iMOVE participation & add. Project contrib.	550,000
PATREC Research Fellows	450,000
Researcher Assistants, Services, Expenses	650,000
Climate action researchers, services, expenses	250,000
Total Expenditure	2,463,234
YTD BALANCE	-227,730
Balance Brought Forward	376,828
CLOSING BALANCE (incl Balance B/F)	149,098

10.9. Key Performance Indicator Targets 2023

Performance indicators include essential academic and policy impact indicators with focus on outputs and outcomes rather than inputs.

Table 10: Key Performance Indicator Targets 2023

Performance Indicator	Target 2023
<i>Academic Performance Indicators</i>	
Number of journal papers published	10
Number of peer-reviewed book chapters published	0
Number of peer-reviewed conference papers published in proceedings	6
Number of peer-reviewed books published	0
Number of post graduate research students attracted (and graduated)	8
Value (\$) of [non-core] research funding secured (through PATREC account)	\$1,732,500
<i>Policy Impact Performance Indicators</i>	
Number of high impact, policy-informing projects/sub-projects completed	7
Number of substantive Technical Reports/Working Papers accepted/published	7
Number of PATREC Perspectives/iMOVE news articles published on PATREC website	5
Number of presentations at PATREC and other connection events (including conference presentations not published)	10
Number of connection events arranged and held	3
Number of short courses, unit contributions presented	2
<i>Stakeholder (academic and policy) satisfaction indicator</i>	90%

ANNEXURE A: PROJECT TECHNICAL REPORTS COMPLETED 2020-2022

Project	Funding Sources and \$	Status
Managing Transport System Investment Risk - Enhancing patronage predictions and adapting strategic asset management and appraisal processes to account for emerging trends and uncertainty – suite of reports (6): <ul style="list-style-type: none"> • Close-out report • Factors Influencing Public Transport Patronage Trends: Perth 2009 to 2019 • Factors Influencing Public Transport Patronage Trends: Perth 2015 to 2019 • Journey Planner Usage Analysis • Adapting Strategic Asset Management Practice for CAV • Maximising Prioritisation of Infrastructure Investment Proposals in the Face of Uncertainty 	\$328,000 (iMOVE, DOT, MRWA)	Completed (2020)
Increasing older people’s acceptance of shared, automated, and electric vehicles	\$129,993 (DOT)	Completed (2021)
Land Use and Freight Generation Analysis - Perth	\$72,000 (DOT, DPLH)	Completed (2021)
Enhancing land-use inputs to strategic transport models through advanced econometrics - CUBE Land Best Practice Review: Literature and User Survey	\$74,600 (DPLH, MRWA, DOT)	Completed (2021)
The implications of working from home for transportation: perspectives, policies and prospects - literature review	\$20,000 (DOT)	Completed (2021)
Multi-objective genetic algorithm optimisation for network widening and maintenance scheduling	\$120,000 (MRWA)	Completed (2021)
Working from Home - suite of reports (7)(External project): <ul style="list-style-type: none"> • Overview • Working from Home: Employee Perspectives - Travel and Values • Working from Home: Employee Perspectives – Work • Working from Home – Changes in Productivity • Working from Home: Policy Response • Working from Home: Employer Perspectives • Working from home: Transport infrastructure demand - Scenario evaluation 	\$240,000 (iMOVE, DoT, MRWA, DPLH)	Completed (2022)
Implementing Zone Perimeter Controls on Perth’s Road Network (external project)	\$102,000 (iMOVE, MRWA)	Completed (2022)
Application of video analytics on Principal Shared Paths (external project)	\$38,000 (WSP, MRWA)	Completed (2022)
Smart Transport Technology Roadmap (external project)	\$200,000 (RAC, iMOVE)	Completed (2022)
Air Health Monitor – Review (external project)	\$18,000 (RAC)	Completed (2022)