



PATREC

Planning and Transport Research Centre

ANNUAL REPORT

2017



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THE UNIVERSITY OF
**WESTERN
AUSTRALIA**



Curtin University



mainroads
WESTERN AUSTRALIA



Department of
Transport

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1 INTRODUCTION

1.1 Purpose

The primary purpose of this report is to provide an update of activities conducted in 2017 with a focus on outputs and outcomes achieved.

1.2 2017 in Focus

The main focus during 2017 was on:

- completion of the five core PATREC projects through the well-functioning project steering committees and the PATREC Research Advisory Committee (PRAC)
- securing external research projects including those associated with the iMOVE CRC.

1.3 Achievements in Brief

- Five PATREC core-funded project completed with Technical Report and draft Perspectives, completed:
 - Project 1: Addressing Future Uncertainties of Perth at 3.5 Million: What-If Scenarios for Mass Transit
 - Project 2: Factors Affecting Travel Behaviour Choice
 - Project 3: An Appraisal of Travel Plans and Voluntary Transport Behaviour Projects
 - Project 4: Understanding Travel Behaviour Patterns and Trends
 - Project 5: Understanding Freight Demand Generation Patterns per Industry Type
- PATREC book “Planning Boomtown and Beyond Book”, launched in June 2017
- iMOVE CRC (Intelligent MObility & Vehicle Evolution) - participation agreement signed and two project agreements submitted for an early 2018 commencement
- Smart Cities and Suburbs grant funding secured for the project “RailSmart Wanneroo Planning Support System”
- Publication of 13 peer-reviewed academic papers and 29 technical reports and non-reviewed conference papers

2 RESEARCH

2.1 Overview of Project Activity in 2017

The focus of project work in 2017 was on completion of five substantive core funded research projects (Table 1). An externally funded ARC LIEF Urban Analytics Data Infrastructure (UADI) project was completed. Two iMOVE CRC projects were conceptualised and projects agreements submitted for approval. A Smart Cities and Suburbs grant project: RailSmart Wanneroo Planning Support System, was awarded.

Table 1: Research Project Activity in 2017

Project	Research Questions and Policy Relevance	Funding and Status
<p>Project 1: Addressing Future Uncertainties of Perth at 3.5 million: What-if Scenarios for Mass Transit</p>	<ul style="list-style-type: none"> Through a classification of station precincts, what is the appropriate infill response (land use mix and intensity) for different station typologies and what are the impacts on patronage? What are the critical density, diversity, and patronage tipping points and threshold levels to inform where and at which stage land-use changes require additional infrastructure or support additional services and when the change is sufficient for viable patronage levels? What are the investments/actions (land-use mix and intensity, infrastructure and non-infrastructure) required to maximise potential synergy (transit and place functions) at particular stations? <p><i>Policy relevance:</i> Implementation of P&P@3.5 million – LU mix and intensity at stations and AC to support 11% mode share target; ICC relevance; Inform business plans for investment in station precincts</p>	<p>Core funded (\$125,000) Completed</p>
<p>Project 2: Factors Affecting Travel Behaviour Change</p>	<ul style="list-style-type: none"> What are the social-psychological motivators influencing travel attitudes and behaviours in different demographic groups which need to be accounted for in tailoring interventions for different demographic segments to change behaviour and reach mode share targets? What are the social-psychological attitudes and potential travel behaviours in response to technical and social change? <p><i>Policy relevance:</i> Will assist in targeting the most appropriate travel demand management interventions for different demographic groups to reach 11% aspirational mode share targets in the transport plan for P&P@3.5.</p>	<p>Core funded (\$100,000) Completed</p>
<p>Project 3: An Appraisal of Travel Plans and Voluntary Transport Behaviour Projects</p>	<ul style="list-style-type: none"> What standardised evidence-based method should be used to appraise specific travel plans for new developments and VTBC projects in order to prioritise TDM funding? What are the benefits of travel plans for new developments and VTBC programs when included as a component of supply side projects including roads, railways and bike paths? What standardised evidence-based method should be used to monitor and evaluate the impacts of travel plans and VTBC projects in order to justify TDM funding as well as make subsequent funding decisions? <p><i>Policy relevance:</i> Will assist in the identification and appraisal of a targeted suite of TDM instruments that will be necessary in managing congestion. In particular, travel plans and DOT's flagship voluntary travel behaviour change (VTBC) program, Your Move.</p>	<p>Core funded (\$55,000) Completed</p>
<p>Project 4: Understanding Travel Behaviour Patterns and Trends</p>	<ul style="list-style-type: none"> What are the spatial-temporal transport usage patterns as evident from SmartRider data in relation to socio-economic factors? What are the origin-destination travel patterns as determined from SmartRider and other available data and how do they compare to modelled patterns? Are there any new patterns of travel which can be discovered through data mining of SmartRider data? <p><i>Policy relevance:</i> Performance monitoring in near real time – could feed into the Directions/P&P@3.5 Annual Report Card; PT OD matrix validation, improve strategic modelling assumptions; inform PARTS survey sample frame, supporting evidence-based policy formulation.</p>	<p>Core funded (\$195,000) Completed</p>

Project	Research Questions and Policy Relevance	Funding and Status
<p>Project 5: Understanding Road Freight Demand Generation Patterns Per Industry Type – Perth Road Freight Analysis</p>	<ul style="list-style-type: none"> • What are the freight patterns generated by different types of industrial activity in metropolitan Perth? • What is the freight generating potential of businesses specialising in warehousing, distribution and logistics, in strategic areas such as Kewdale-Forrestfield-Hazelmere and the port precincts? • Why do businesses of various types locate in particular areas, and what are the barriers and costs associated with relocation to other areas, including new industrial zones, which might offer economic benefits? • What is the potential for improved use of rail for metropolitan freight by the various sector activities? <p><i>Policy relevance:</i> Will provide much-needed data on road freight activity (scale, nature, origin-destination pattern and growth trends) and support planning for economic clusters</p>	<p>Core funded (\$105,000) Completed</p>
<p>ARC LIEF Urban Analytics Data Infrastructure (UADI) Project</p>	<p>Led by University of Melbourne, Centre for Spatial Data Infrastructures and Land Administration, in collaboration with 11 other investigators from five other Australian universities, the ARC LIEF Urban Analytics Data Infrastructure (UADI) Project was successfully completed and launched in Melbourne on 24 October 2017.</p> <p>This project aimed to develop an urban analytics data infrastructure that builds on the Australian Urban Research Infrastructure Network. This digital data infrastructure intends to enable the integration, harmonisation, connectivity and scalability of multi-source urban datasets. This infrastructure is required to underpin the next generation of data-driven modelling and decision-support tools to enable the design of smart, productive and resilient cities. These capabilities are predicated on the adoption of ISO standards, development of new ontological frameworks and an urban data dictionary to enable semantic inferencing of datasets and the development of data structures and services. This framework would then be applied to data relevant to people, land and urban infrastructure to support comparative and multi-dimensional analytics.</p> <p>PATREC worked with The University of Melbourne to develop a flexible accessibility tool that can be theoretically applied to any cities in the world, as long as the data is available. It is also flexible in terms of what kind accessibility the user wants to analyse, e.g. access to jobs, hospital beds, potential employees. Using openly available data, accessibilities at the SA2 level for all five major capital cities in Australia were produced as case studies. The tool was chosen as a live showcase of major components during the UADI launch event. The results will be provided on, or a link provided to, the PATREC website, as well as the data.</p>	<p>Externally funded (\$90,000) Completed</p>
<p>iMOVE CRC Project: Enhanced short and longer term network performance prediction capabilities through data-driven analytics and simulation</p>	<ul style="list-style-type: none"> • This project aims to improve the ability of road authorities to predict network performance in the short term using data-driven analytics and to incorporate the impact of Automated Vehicles (AVs) in longer term predictions. The project has two subprojects: <ul style="list-style-type: none"> • Subproject 1: Develop mathematical and data-driven empirical models for short-term traffic prediction (15-30 minutes timeframe). The prediction will be done on link level as well as area level. It aims at utilising emerging traffic datasets to improve network operations. • Subproject 2: Simulate the traffic impact of AVs to Perth's freeways. It focuses on long-term strategic planning in the era of Automated Vehicles 	<p>Core and externally funded (\$) Project Agreement submitted for approval</p>
<p>iMOVE CRC Project: Planning intermodal and general logistics infrastructure for the future needs of Perth</p>	<p>This project consists of a suite of related research streams to support the state of WA and the WestPort Taskforce in the planning for landside logistics infrastructure and services for a new container berth to be developed in Kwinana to support container trade growth. Studies will include analysis of aspects of intermodal systems in order to maximise the future use of short haul rail freight services, and research into global supply chain trends which could affect industrial land use and freight transport service provision. A targeted research component will also trial the use of GPS fleet management data for use in an urban transport policy setting</p>	<p>Project Agreement submitted for approval</p>

Project	Research Questions and Policy Relevance	Funding and Status
Smart Cities and Suburbs grant: RailSmart Wanneroo Planning Support System	<p>The City of Wanneroo is one of the fastest growing outer council regions of metropolitan Perth and the council has identified the need to improve city planning to adequately accommodate population growth. This project will adapt existing planning support tool technology currently used for state-level land use planning and implement it for use at a local level. A data-driven planning support system, the RailSmart Planning Support System (RailSmart PSS), will evaluate, predict and monitor development impacts, underpinned by multiple data sources, integrating new smart ticketing, mobile app and road sensor data.</p> <p>The project objectives are:</p> <ol style="list-style-type: none"> To harness, apply, calibrate and embed Planning Support Tools with supporting data to catalyse the process of attracting strategic employment opportunities to key transport nodes to meet stretching targets and creating more local work opportunities, reducing the need to travel. To employ, test, calibrate and embed Planning Support Tools with supporting data to promote and monitor travel behaviour choice and change in communities to more sustainable travel modes, in particular increasing levels of public transport patronage through a suite of services including last-mile accessibility improvements. 	Externally funded (\$1 million - ending June 2019 from Commonwealth (\$500K, DOT \$100K, UWA \$160K, ECU \$40K and City of Wanneroo \$200K)

3 KNOWLEDGE TRANSFER

3.1 PATREC Connection Events

Planning boomtown and Beyond Book Launch

PATREC celebrated the launch of Planning Boomtown and Beyond at a cocktail function held at the University of Western Australia Club on Monday, 12 June 2017. The event was attended by over 50 authors, reviewers, representatives from PATREC's university and government partners, and other transport and planning related organisations. UWAP have sold 20 copies, and nearly 100 books have been distributed to authors, reviewers, Board and PRAC members.

PATREC Seminar

A PATREC seminar, "Vulnerability analysis for transportation networks", was held at 140 William on Friday, 29 September 2017, presented by Professor Michael A P Taylor of the University of South Australia. It was attended by 40-50 people. This seminar presented an overview of the concepts, theories and methods adopted for vulnerability analysis of transportation networks, dealing with the identification of critical locations and infrastructure components in those networks, the estimation of the potential impacts of network degradation or failure, and planning and design for remedial actions. It summarised the core definitions of network vulnerability and outlined the broad approaches to vulnerability analysis, which included the use of network accessibility metrics.

Research Week Debate

As part of the UWA Research Week, PATREC held a successful event with 55 people attending, on Thursday, 7 September 2017, in the form of a debate deliberating "Will ride sharing and driverless vehicle technology solve city challenges (congestion and urban sprawl), by reducing cars on the road, freeing up streets and parking lots for place-making and rich urban spaces (the Less team)? Or, will driverless technology induce greater demand for travel resulting in more cars on the road and even greater spreading out of the city (the More team)".

Members of the teams were:

More: **Chao Sun**, Research Fellow, PATREC (UWA)

Laura Gladstone, Consultant

Anthony Duckworth-Smith, Assoc/Prof, Lecturer, Australian Urban Design Research Centre, UWA

Pascal Felix, Intelligent Infrastructure Executive, WSP Australia

Less: **Sarah Macaulay**, Manager, Transport Planning Advocacy and Members, RAC

Simon Grieve, Director Strategic Transport Analysis and Reform, Department of Transport

Craig Standing, Centre for Innovative Practice, Edith Cowan University

Ben Harvey, Director of Policy within the Department of Planning, Lands and Heritage

PATREC Research Forum

A half day Research Forum was held on Monday 6 November at the Australian Urban Design Research Centre to present the findings of the five PATREC core research projects. The Keynote Address "*Curitiba, Brazil: Before B.R. T. & Beyond*" was presented by Professor Joseli Macedo, Head of the School of Built Environment at Curtin University. The forum was attended by up to 60 collaborators and industry professionals. Presentation were as follows:

- Associate Professor Doina Olaru: Addressing Future Uncertainties of Perth at 3.5 Million: What-If Scenarios for Mass Transit
- Professor Craig Standing: Sharing Economy and Its Impacts on Transport
- Dr Cath Ferguson: Review and Testing of Behaviour Change Theories
- Dr David Lamb: Active Travel and Public Transport Among Two Specific Demographic Groups in Metro Perth
- Dr Brett Smith: An Appraisal of Travel Plans and Voluntary Transport Behaviour Projects
- Tristan Reed/S Zhang Nau: Smart Rider Portal
- Travis Povey: Smart Rider Data Driven Analysis
- Tim Hoffman/Sam McLeod: Understanding Freight Demand generation Patterns per Industry Type

3.2 Research Outputs

The focus of PATREC's research outputs in 2017 was on the publication of technical reports emanating from the core funded research project 1-5 (Table 2).

Seven peer-reviewed journal papers were published in 2017 (Table 3). A total of 20 conference papers were presented with six published in proceedings (Table 2). Six journal papers and book chapters were submitted or re-submitted for publication (Table 3).

Table 2: Research Outputs in 2017

Publication Title	Author/s	Publication Date
RESEARCH PROJECT TECHNICAL REPORTS COMPLETED		
Project 1: Addressing Future Uncertainties of Perth at 3.5 Million: What-If Scenarios for Mass Transit	Doina Olaru, Simon Moncrieff, Gary McCarney, Tristan Reed, Yuchao Sun, Cate Pattison, Brett Smith, Sharon Biermann	Nov 2017
Project 2: Factors Affecting Travel Behaviour Choice	Cath Ferguson, David Lamb, Craig Standing, Susan Standing, Brett Smith, Tim Perkins, Laura Gladstone, Jessica Crisp, Sharon Biermann	Nov 2017
Project 3: An Appraisal of Travel Plans and Voluntary Transport Behaviour Projects	Brett Smith, Ying Huang, Thrivek Vijayakumar, Tyler Smith, Sharon Biermann	Nov 2017
Project 4.1: Understanding Travel Behaviour Patterns and Trends – macro analysis	Simon Moncrieff, Tristan Reed, S Zaung Nau, Sharon Biermann	Nov 2017
Project 4.2: Understanding Travel Behaviour Patterns and Trends – micro analysis	Rachel Cardell-Oliver, Travis Povey, Lidia Dokoucheva, Jianxin Li, Jordan Lilburne, Sharon Biermann	Nov 2017
Project 5: Understanding Freight Demand Generation Patterns in Perth	Tim Hoffman, Sam McLeod, Carey Curtis, Hendrik Braun, Sharon Biermann	Nov 2017
Urban Analytics Data Infrastructure – Accessibility Tool (ADAPT)	Chao Sun, Gary McCarney, Sharon Biermann	Oct 2017
JOURNAL PAPERS PUBLISHED		
Children’s active travel, local activity spaces and wellbeing: A case study in Perth, WA, Travel Behaviour and Society, (in press) https://doi.org/10.1016/j.tbs.2017.06.002	Babb, C., Olaru, D., Curtis, C., & Robertson, D.	2017
Policy-led selection of the most appropriate empirical model to estimate hedonic prices in the residential market”, Journal of Transport Geography, 62, 213–228.	Olaru, D., Mulley, C., Smith, B., & Ma, L.	2017
Strategic Planning for Employment Self-Containment in Metropolitan Sub-Regions. Urban Policy and Research, 1-12.	Martinus, K. & Biermann, S.	2017
Assessing the accessibility of activity centres and their prioritisation: a case study for Perth Metropolitan Area. Urban, Planning and Transport Research, 5(1), 1-21.	Moniruzzaman, Md., Olaru, D. & Biermann, S.	2017
Electric Vehicles Adoption: Environmental Enthusiast Bias in Discrete Choice Models, Transportation Research D, 51, 290-303.	Smith, B., Olaru, D., Jabeen, F. & Greaves, S.	2017
Road to autonomous vehicles in Australia: an exploratory literature review, Road and Transport Research, 26(1), 34-47	Sun, Y., Olaru, D., Smith, B., Greaves, S., and Collins, A.	2017
Adapting principles of developmental biology and agent-based modelling for automated urban residential layout design. Environment and Planning B: Urban Analytics and City Science.	Sun, Y., & Taplin, J.	2017

CONFERENCE PAPERS PRESENTED AND PUBLISHED IN PROCEEDINGS		
Evaluation of the Wheatbelt Aged-Friendly Community Bus Trial, 39th Australasian Transport Research Forum and the 4th Transport Knowledge Conference , 27-29 November 2017, Auckland.	Burnham, L., Arnold, B., Huang, Y., Aitkens, M., Smith, B. and McKenzie, F.	2017
A flexible accessibility analysis tool for enhanced urban analytics, 39th Australasian Transport Research Forum and the 4th Transport Knowledge Conference, 27-29 November 2017, Auckland	Sun, Y., McCarney, G., Sabri, S., Amirebrahimi, S., Agunbiade, M., Chen, Y., Keshtiarast, A., Kalantari, M., Bright, C., Oлару, D., Reynolds, M., Rajabifard, A., & Biermann, S.	2017
What's driving public transport in Perth: Understanding Determinants and Dynamics, 15th International Conference on Computers in Urban Planning and Urban Management (CUPUM), 11-14 July 2017, Adelaide, Australia.	Nau, S	2017
A Value Driver Model for Network Operations, AITPM Conference proceedings, 15-17 August 2017, Melbourne, Australia.	Jacoby, G., Chidgzy, S., & Sun, Y	2017
New data collection methods for Researching Travel Behaviour: Wearable Cameras and Activity Monitors, <i>11th International Conference on Transport Survey Methods</i> , 24-29 September 2017, Quebec, Canada.	Harms, T., Muroi, G., Oлару, D., Smith, B., Cangiano, F., & Sun, Y.	2017
Using Diary Data to Analyse Travel Behaviour: Findings from the UK. Paper presented at the 11th International Conference in Transport Survey Methods (ISCTSC), Esterel, Canada, 24-29 September.	Harms, T., Gershuny, J., Oлару, D.	2017
CONFERENCE PAPERS PRESENTED		
Ride Sharing and Driverless Cars: Adapting Our Cities for the Future" at the <i>UDIA National Congress, Today's Vision, Tomorrow's Reality</i> , 4-6 April 2017 in Perth.	Biermann, S.	2017
Residential Location and Dwelling Choice Models for Market Data, <i>International Choice Modelling Conference</i> , 3-5 April 2017, Cape Town, South Africa.	Hess, S., Smith, B., Oлару, D., Beck, M., & Daly, A.	2017
Interpreting models of risk in a random utility setting, <i>International Choice Modelling Conference</i> , 3-5 April 2017, Cape Town, South Africa.	Huang, Y., Smith, B., & Oлару, D.	2017
Planning Boomtown and Beyond (Special Session), 15th International Conference on Computers in Urban Planning and Urban Management (CUPUM), 11-14 July 2017, Adelaide, Australia.	Biermann, S.	2017
Pondering the Imponderable, or Building the Best? Technology Take-up & 2050 Travel Demand, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia.	Gladstone, L.	2017
Is Sharing the Model of Autonomous Vehicle Adoption, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia.	Crisp, J.	2017

Evaluating the Economic Benefits of Density & Land Use Around railway Stations through the Assessment of Travel Behaviour, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia	Vijayakumar, T.	2017
The Evaluation of Functions & Algorithms of LinSig & SIDRA, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia	Hou, X., Sun, Y., & Hu, Y.	2017
Estimating Trip Length on a Freeway & Its Impact on Outflow, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia.	Jacoby G., Wolf, P., Chidzey, S., & Sun, Y.	2017
Spatial Data Analytics framework for Exploring Perth Public Transport Usage, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia.	Moncrieff, S., Reed, T.	2017
Travel Mode Intentions & Decisions – Active Travel & Public Transport in Metro Perth, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia	Lamb, D.	2017
Assessing the Effect of Active Versus Sedentary Modes of Transport on Stress Recovery”, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia.	Harms, T., Cangiano, F., Smith, B., Sun, Y., & Oлару, D.	2017
‘Wearables’ for travel behaviour and health, Conference of Australian Institutes of Transport Research 2017, 4-7 December 2017, Perth, Australia	Harms, T., Oлару, D., Smith, B., Sun, Y.	2017

Table 3: Journal Papers Submitted or Re-submitted in 2017 for Publication

Title of Paper	Authors
A Literature Survey and Future Prospects of Revenue Management in Road Freight Transport. Transport Reviews (resubmitted to <i>Journal of Physical Distribution & Logistics Management: Special Issue</i>)	Braun, H.
Revenue management in road freight transport: Capacity control and dynamic request integration under profit maximisation (resubmitted to <i>Journal of Transportation Science</i>)	Braun, H.
The Implications of the Sharing Economy for Transportation, Transport Reviews. Accepted for publication in 2018 http://www.tandfonline.com/action/showCitFormats?doi=10.1080/01441647.2018.1450307	Standing, C., Standing, S., & Biermann, S. (2018)
Optimizing bus stop locations for walking access: stops-first design of a feeder route to enhance a residential plan. Environment and Planning B: Urban Analytics and City Science.	Sun, C and Taplin, J
Using Microsimulation of City Traffic to Determine a Cordon Charge Based on marginal Network Social Cost, Economics of Transportation	Sun, Y. & Taplin, J.
Urban Freight Transport Demand Generation by Land Use: A comprehensive literature review and syntheses of findings, Transport Reviews.	McLeod, S. & Curtis, C.

3.3 Research Impact

Research Project Outcomes

Further research commissioned

- Lead researchers from Projects 1 and 4.2 were engaged to undertake further integrated analysis, building on the outputs of projects 1 and 4.2, in order to provide the Department of Transport with evidence to support the process of identifying stations most suitable for Your Move behaviour change programs.

Constructive and in some cases, complimentary feedback was obtained from Steering Committee members after reviewing draft Technical Reports for Projects 1-5. A selection of email comments received are included below:

- Addressing Future Uncertainties of Perth at 3.5 Million: What-If Scenarios for Mass Transit (Project 1):
 - By way of feedback, it's great to see that the report responds to the brief to develop an understanding of the land use intensification/ other interventions required to strengthen patronage at underperforming stations, in addition to the initial station profile component of the research. The findings also give credence to the development of station typologies and adopting appropriate interventions to grow patronage and otherwise enhance liveability and vibrancy, as opposed to a one size fits all approach (*Carmel Quin, Manager Strategic Infrastructure, Policy and Priority Initiatives, from email sent on 19/10/2017*)
- An Appraisal of Travel Plans and Voluntary Transport Behaviour Projects (Project 3):
 - "You might be happy to know the P-RAM is gaining popularity both internally at DoT and externally at a national level. Sue is a member of the national TDM Senior Officials Working Group who are interested in viewing the P-RAM model...You may already know this, but the TDM Senior Officials Working Group is a sub-group of the Infrastructure Working Group, which belongs to the COAG Transport and Infrastructure Council. The Council is responsible for coordinating the ATAP guidelines, so they clearly have a special interest in the P-RAM" (*Liam Heitson, Senior Market Analyst, Transport Strategy and Reform, from email sent 20/8/2017*)
 - This is very impressive and clearly represents a great deal of effort and expertise in development and delivery. I suggest this open approach to access will enhance the uptake and application of the tool which in turn will support sound decision-making around TDM development and implementation. I applaud you all for your innovation and initiative (*Sue Hellyer, Director Congestion Policy and Programs, Transport Strategy and Reform, Department of Transport, from email sent 21/8/2017*)
- Understanding Travel Behaviour Patterns and Trends – macro analysis (Project 4.1):
 - "Being of a highly technical nature we appreciate the involved work that has contributed to the development of a proof of concept of a decision support system such as this and congratulate you for it. We are obviously keen to know when you anticipate phase two – a demonstrator project will commence and whether you require our assistance to identify problems to be addressed using SmartRider data? If so please let us know and we are happy to begin facilitating this. Once we are at this subsequent stage we anticipate that this work will be extremely valuable to provide insights for the development of transport policy, planning and decision making (*Claire Thompson, Manager Congestion Policy, Transport Strategy and Reform, Department of Transport, from email sent on 26/9/2017*)
 - I am responding on behalf of PTA as the lead Transperth reporting analyst. I've reviewed your report and am impressed by the findings and project potential. I would welcome the opportunity to investigate the work in more detail and compare the model outputs to my

own SmartRider models and datasets. From the report it appears the data and SmartRider methodology is correct however I'd be much more comfortable if I could compare the numbers to our own datasets....Going forward I'd like to meet the PATREC project team and discuss the SmartRider data or Transperth modelling and reporting direction/requirements. Having read through the report I can see a number of ways we could potentially aid the project going forward, or better support final solution upkeep. I can also see this work aligns closely with work I have undertaken independently (to a much lesser scale) and aligns to some of the items I've wanted to investigate going forward. There is a lot of work happening around SmartRider data (involving PTA, Transport, and Treasury) and many benefits to a streamlined approach. With PTA also commencing major upgrades to the SmartRider system I am keen to ensure data requirement needs are met if possible to aid future analytics. A lot of the problems you experienced with journey data also cause problems with internal Transperth reporting so it's best if we can address them as close to the source as possible *(Brendan Lumbers, Business Analyst, Ticketing and Performance Transperth System, Regional Town and School Bus Services, from email sent on 25/9/2017)*

- Understanding Travel Behaviour Patterns and Trends – micro analysis (Project 4.2):
 - We appreciate that the findings of your work on travel behaviour patterns will have a great deal of value for us and particularly significant for our work around influencing people's travel choices and travel demand. This is the kind of data we are interested in having access to in order to inform our evidence-based policy making around how we maximise use of our transport network and our transport investment. Your report states that you will provide a dashboard reporting system for policy makers that can be used by other PATREC projects – how can we get access to the databases/visualisation tools that has been developed as part of this PATREC project which can generate reports on hubs, passengers and journeys to inform our policy thinking? We would be particularly keen to have access to this kind of data given that the snapshot provided in Table 1 on page 12 with selected Perth hubs with volumes/activities highlights some very interesting time of day travel patterns. It would also be great if we could drill down further into the patterns of the identified activity hubs (page 1 of the report notes that one of the findings of the project includes discovery of 295 hubs that are high volume activity centres accessed by public transport where people engage in some activities for 2 to 16 hours). *(Claire Thompson, Manager Congestion Policy, Transport Strategy and Reform, Department of Transport, from email sent on 18/10/2017)*

Stakeholder Satisfaction Survey Results

An on-line survey, comprising nine questions, was developed using Qualtrics to provide feedback to the Director and Board on the level of satisfaction of PATREC partners with the performance of PATREC on an annual basis.

The first survey was conducted in February 2017, limited to Board and PRAC members only (n=8), to test the survey instrument and also to set the baseline satisfaction level. For the purpose of providing the baseline satisfaction level as a KPI (Table 11), the degree to which stakeholders agreed with the statement "Overall, I am satisfied with PATREC's performance" (strongly agree, somewhat agree, somewhat disagree, strongly disagree) was converted to a percentage satisfaction rate. A baseline satisfaction index of 79% was achieved. Results for all nine questions are used for more detailed reporting to the Board.

The survey was repeated in January 2018 but extended to include not only Board and PRAC members but also project Steering Committee members and for gauging the level of satisfaction with performance in individual projects (n=26). The January 2018 survey indicated a drop in the overall level of satisfaction with PATREC's performance to 71% as a results of more university respondents disagreeing that they are satisfied with PATREC's performance and with a shift to more government partners "somewhat agreeing" rather than "strongly agreeing" (Figure 1).

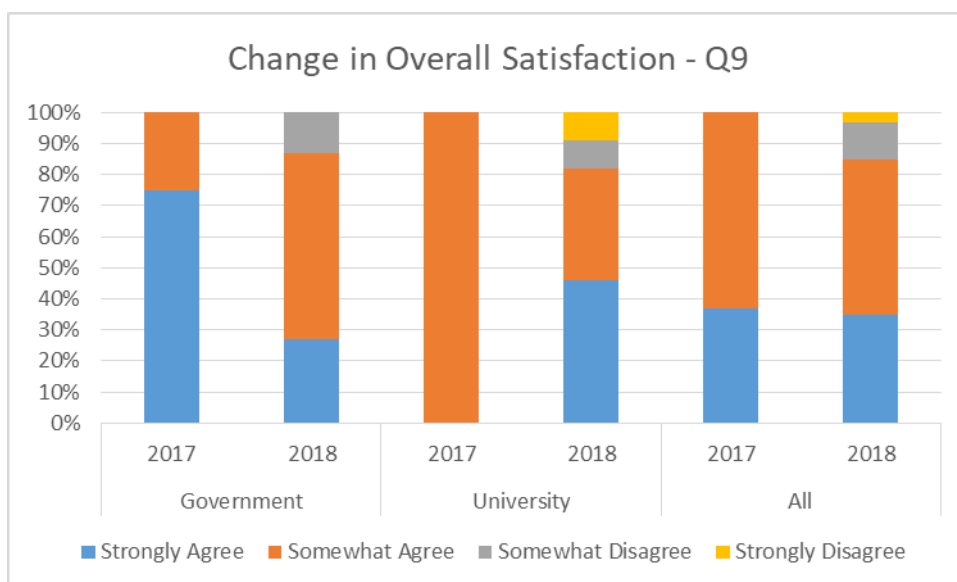


Figure 1: Change on overall satisfaction with PATREC’s performance (between February 2017 and January 2018)

4 PEOPLE AND RESOURCES

4.1 Staffing

With leadership, administration and coordination by a small PATREC core team (Table 4), a much wider team of PATREC project research associates from across the partner universities and with some support from adjuncts, consultants (Table 5) and PhD students (Table 6), were involved in conducting policy-informing, applied research. Through the mechanism of project steering committees (Table 7), researchers were supported and enabled by a dedicated team of agency stakeholders who ensured that PATREC research is well-aligned with policy objectives and that the research outcomes are well-communicated within the agencies and more broadly if required.

Table 4: Research Administration, Development, Coordination and Management

PATREC Office		
Prof Sharon Biermann	0.4 FTE	Director
Dawn Woods	0.8 FTE	Centre Administrator
Research Development, Coordination and Management		
Prof Sharon Biermann (PATREC)	0.6 FTE	Director
Dr Chao Sun (PATREC)	0.4 FTE	PATREC@UWA
Mike Ridout (Curtin)	0.4 FTE	PATREC@Curtin
Dr Catherine Ferguson (ECU)	0.2 FTE	PATREC@ECU

Table 5: PATREC Project Research Associates

PATREC Research Assoc.	Faculty/School/Centre	Uni.	PATREC Research Assoc.	Faculty, Dept, School	Uni.
Mike Ridout	Spatial Sciences	Curtin	A/Prof Rachel Cardell-Oliver	Computer Science	UWA
Dr Ulanbek Turdukulov	Spatial Sciences	Curtin	Dr Wei Liu	Computer Science	UWA
Dr Simon Moncrieff	Spatial Sciences	Curtin	Dr Jianxin Li	Computer Science	UWA
Tristan Reed	Spatial Sciences	Curtin	A/Prof Mark Reynolds	Computer Science	UWA
Dr S Zhang Nau	Information Systems	Curtin	Tim Perkins	Centre for Planning	ECU
E/Prof Geoff West	Spatial Sciences	Curtin	Dr Cath Ferguson	Business and Law	ECU
Sam McLeod	Planning & Geog.	Curtin	Dr David Lamb	Business and Law	ECU
Dr Courtney Babb	Planning & Geog.	UWA	Prof Craig Standing	Business and Law	ECU
Dr Chao Sun	PATREC	UWA	Dr Susan Standing	Business and Law	ECU
A/Prof Doina Olaru	Business School	UWA	Gary McCarney	Adj Research Fellow	UWA
Dr Brett Smith	Business School	UWA	Laura Gladstone	Consultant	-
Ying Huang	Business School	UWA	Tim Hoffman	THAdvisory	-
Hendrik Braun	Business School	UWA	Paul McLeod	Adj Prof UWA	UWA
A/Prof Paul Bergey	Business School	UWA	John Taplin	E/Prof UWA	UWA

Table 6: PATREC PhD Top-up Scholarships since 2013

Name and institution	Status	Topic
James McIntosh (Curtin)	Awarded in 2014, completed in 2015	Infrastructure Funding
Sai Kumar (Curtin)	Awarded in 2014, last year scholarship withdrawn	Infrastructure Funding
Daniel McDonald (ECU)	Awarded in 2014, withdrew in 2015	Accessibility/Vampire Index
Hendrik Braun (UWA)	Awarded in 2015, submitted in 2017	Freight

Table 7: Project Steering Committee Participation

Agency	Project 1	Project 2	Project 3	Project 4	Project 5
DoP	Craig Shepherd Damien Martin		Craig Shepherd	Damien Martin	Craig Shepherd
DoT	Renlong Han Sue Hellyer	Simon Grieve Renlong Han	Sue Hellyer Alison Bunbury Andrew Wilkinson	Renlong Han Sue Hellyer	Anne-Marie Brits Caroline Elliott
MRWA		Kamal Weeratunga	Mehdi Langroudi	Wes Soet	Wes Soet
PTA	Louise Howells Jamie Mullins	Tom Pacy	Simon Cox Louise Howells	Tom Pacy/ Martin White	
Treasury	Coan Harvey		Coan Harvey Vivian Pinter	Laura Cook	

4.2 Finances

The 2017 year ended with a balance of just under \$200K, \$63K under budget largely as a result of not achieving anticipated levels of “other” income (Table 8). Expenditure was only just under 100K under budget. The closing balance was, however, significantly higher than the forecast of only 26K as a result of holding back of final core project payments until final deliverables were produced to the satisfaction of project steering committees and the PRAC. These final payments were made in the first quarter of 2018.

Table 8: Financial Summary for 2017

PATREC Income and Expenditure 2017	YTD Actual 31 Dec 17	Budget 2017	Variance Budget vs YTD Actual
INCOME			
WA Government Grants	248,450	240,000	8,450
Partner Universities Sponsorship	215,000	180,000	35,000
Other Research Grants & Contracts	34,082	400,000	365,918
Accrued Interest	910	25,000	24,090
Total Income	498,442	845,000	346,558
EXPENDITURE			
PATREC Office	190,127	204,178	14,051
Research	784,670	869,118	84,448
Total Expenditure	974,797	1,073,296	98,499
YTD BALANCE	-476,355	-228,296	248,059
Balance Brought Forward from 2016	672,849	488,265	184,584
CLOSING BALANCE (incl Balance B/F)	196,494	259,969	63,475

5 GOVERNANCE

5.1 Board Members

The PATREC Advisory Board comprises a senior representative of each of the collaborating Parties and a Chair who is independent of all Parties. The PATREC Director is an ex officio member of the Advisory Board. Reece Waldock, replaced Fred Affleck who retired, as Chair of the Board. Prof Margaret Jones replaced Mr Tim Perkins as the ECU member and Steve Beyer replaced Graeme Doyle who retired, as the Department of Transport member (Table 10).

Table 9: PATREC Board Members

2016	2017
Adjunct Prof Fred Affleck, Independent Chair	Adjunct Prof Reece Waldock, Independent Chair
Mr Eric Lumsden, Chair, Western Australian Planning Commission	Mr Eric Lumsden, Chair, Western Australian Planning Commission
Mr Peter Woronzow, Acting Managing Director, Main Roads Western Australia	Mr Peter Woronzow, Acting Managing Director, Main Roads Western Australia
Mr Graeme Doyle, Managing Director, Policy Planning and Investment, Department of Transport	Mr Steve Beyer, Acting Managing Director, Policy Planning and Investment, Department of Transport
Prof Keith Hampson, Chief Executive Officer, SBEnrc, Curtin University	Prof Keith Hampson, Chief Executive Officer, SBEnrc, Curtin University
Mr Tim Perkins, Program Director Centre of Planning, ECU, Edith Cowan University	Prof Margaret Jones, Director, Office of Research and Innovation, Edith Cowan University
Prof Matthew Tonts, Head of School of Earth and Environment, The University of Western Australia	Prof Matthew Tonts, Pro Vice Chancellor/Executive Dean, Faculty of Arts, Business, Law and Education, The University of Western Australia
Prof Sharon Biermann, Director PATREC	Prof Sharon Biermann, Director PATREC

5.2 PATREC Research Advisory Committee members

Comprising one to two senior representatives from each partner organisation, chaired by a nominated representative of one of the government partners, elected by the Advisory Board, the objectives of PRAC are to:

- introduce an element of formality and rigour to the research project identification, selection, support, monitoring and dissemination process;
- enhance communication amongst partners; and
- advise the Advisory Board on project level matters, allowing the Advisory Board to focus on strategic matters.

Mr Brett Hughes was elected as the inaugural Chair of the PRAC (Table 11) and Craig Shepherd was elected Deputy Chair during 2017.

Table 10: PATREC Research Advisory Committee Members

Name	Organisation
Brett Hughes (Chair)	Department of Transport
Craig Wooldridge	Department of Transport
Douglas Morgan	Main Roads WA
Kamal Weeratunga	Main Roads WA
Damien Martin	Department of Planning
Craig Shepherd (Deputy Chair)	Department of Planning
Owen Thomas	Public Transport Authority
Prof Keith Hampson	Curtin University
Mike Ridout	Curtin University
Tim Perkins	Edith Cowan University
Dr Cath Ferguson	Edith Cowan University
Assoc Prof Doina Olaru	The University of Western Australia
Dr Brett Smith	The University of Western Australia

6 PERFORMANCE AGAINST KPIS AND TARGETS

Broad key performance indicators set for PATREC relate directly to the value-add role or purpose that PATREC was established for. The university collaborators require an increase in research profile and performance while the government partners require better evidence on which to base policy and investment and development spending decisions. The number of performance indicators has been reduced to essential academic and policy impact indicators with focus on outputs and outcomes rather than inputs.

Table 11: Performance against Targets 2017

Performance Indicator	Target 2017	Achieved in 2017
Academic Performance Indicators		
Number of journal papers published (see Table 2)	3	7
Number of peer-reviewed book chapters published	0	0
Number of peer-reviewed conference papers published in proceedings (see Table 3)	7	6
Number of peer-reviewed books published	0	0
Number of top-up sponsored PhD graduated	1	0
Value (\$) of [direct] external research funding secured (through PATREC account, including additional funds from partners)	\$400,000	\$77,532
Value (\$) of [indirect] external research funding secured (through individual partner university account)	\$0	\$0
Policy Impact Performance Indicators		
Number of high impact, policy-informing projects completed	5	6
Number of substantive Technical Reports published	5	6
Number of PATREC Perspectives published on PATREC website	3	5*
Number of presentations at PATREC and other connection events (including conferences (14) and Research Forum (9))	5	23
Number of connection events arranged and held	5	4
Number of short courses, unit contributions presented	2	0
Stakeholder (academic and policy) satisfaction indicator (qualitative)	80%	72%

*drafts