PATREC

Planning and Transport Research Centre

ANNUAL REPORT

2018

www.patrec.uwa.edu.au

CONTENTS

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Date	April 2019
Version	FINAL

1 INTRODUCTION

1.1 Purpose

The primary purpose of this report is to provide an update of activities conducted in 2018 with a focus on outputs and outcomes achieved.

1.2 2018 in Focus

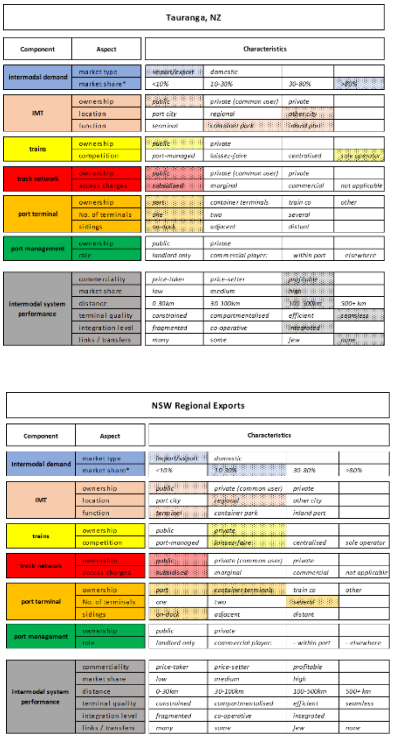
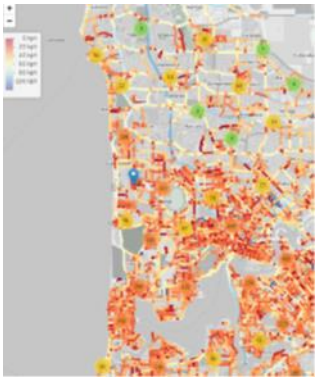
- iMOVE CRC WA Projects (18 month duration) launched and substantially progressed
    - Enhanced short and longer term network performance prediction capabilities through data-driven analytics and simulation – project agreement executed on 22 January 2018
    - Planning intermodal and general logistics infrastructure for the future needs of Perth – project agreement executed on 24 January 2018
- Smart Cities and Suburbs grant agreement signed on 7 February 2018, ending 1 May 2019, substantially progressed
    - RailSmart Wanneroo Planning Support System
    - $1 million project over 18 months (500K from Commonwealth, Smart Cities and Suburbs Grant)
    - Cash contribution WA 500K (UWA 160K, City of Wanneroo 200K, DOT 100K, ECU 40K)
- Additional funding secured to supplement core iMOVE projects
    - MRWA - $200K to ITS project ($100K/annum 2 years)
    - DOT, Arc Infrastructure and Fremantle Ports – $25K each to the Freight project (2018)
- Four smaller external projects completed
- Process to identify next round of core PATREC projects (2019-2021) commenced in July
- PATREC human resourcing strengthened
    - Director awarded ongoing contingent appointment
    - Research Project Manager commences (RailSmart Wanneroo, Linda Robson)
    - Transport Economist/Engineer postdoctoral research fellow commenced (Sae Chi)
    - Chao Sun contract renewed
    - Curtin research assistant appointed (Tristan Reed)
- Director appointed Westport Workstream Chair/Peer Reviewer: Multi-Criteria Assessment
- ARC Linkage proposal submitted - Rethinking integrated land-use and transport (LUTI) systems (with support (cash and in-kind) from DPLH, Landcorp and DOT)
- Publication of 14 peer-reviewed academic papers and 10 technical reports and non-reviewed conference papers

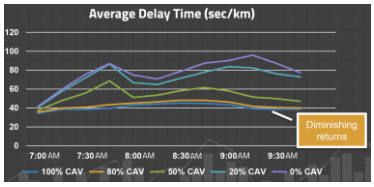
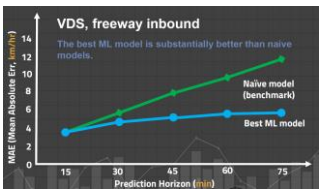
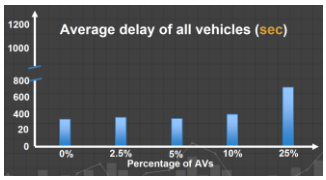
2 RESEARCH ACTIVITY

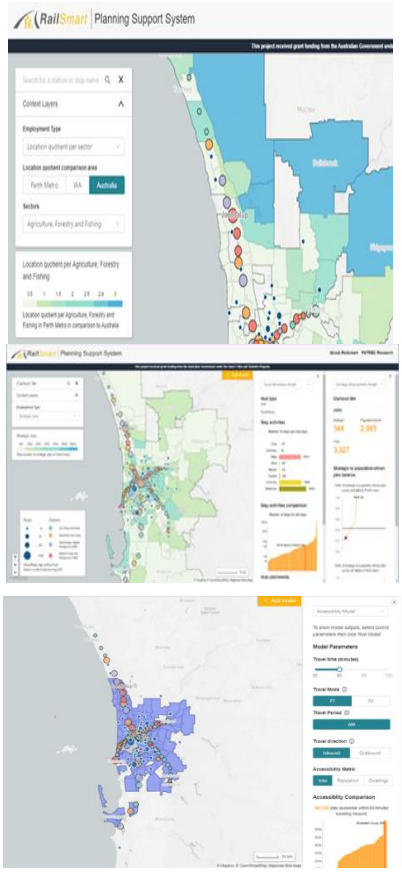
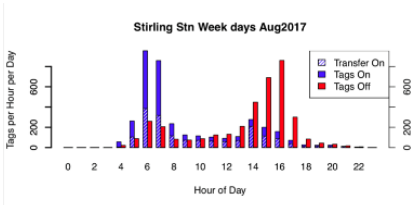
2.1 Research project and proposal progress

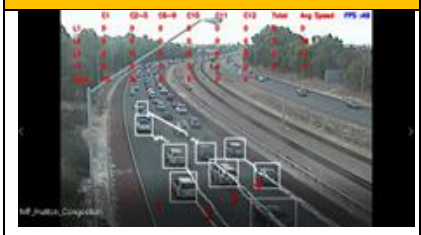
The focus of project work in 2018 was on achieving significant progress milestones for two iMOVE CRC projects and the Smart Cities and Suburbs grant project, RailSmart Wanneroo Planning Support System. Two smaller, external projects were completed. An ArcLinkage grant and cycling proposal were submitted (Table 1).

Table 1: Summary of Research Project Activity in 2018

Research Questions and Policy Relevance	Findings to date	2018 Deliverables
iMOVE CRC Project: Planning intermodal and general logistics infrastructure for the future needs of Perth		
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  Tauranga, NZ Component / Aspect / Characteristics Intermodal demand: market type (import/export; domestic); market share* (<10%; 10-30%; 30-80%; >80%) IMT: ownership (public; private (common user); private); location (port city; regional; other city); function (terminal; container park; inland port) trains: ownership (public; private); competition (port-managed; laissez-faire; centralised; sole operator) track network: ownership (public; private (common user); private); access charges (subsidised; marginal; commercial; not applicable) port terminal: ownership (port; container terminals; train co; other); No. of terminals (one; two; several); sidings (on-dock; adjacent; distant) port management: ownership (public; private); role (landlord only; commercial player; within port; elsewhere) Intermodal system performance: commerciality (price-taker; price-setter; profitable); market share (low; medium; high); distance (0-30km; 30-100km; 100-300km; 300+ km); terminal quality (constrained; compartmentalised; efficient; seamless); integration level (fragmented; co-operative; integrated); links / transfers (many; some; few; none) NSW Regional Exports Component / Aspect / Characteristics Intermodal demand: market type (import/export; domestic); market share* (<10%; 10-30%; 30-80%; >80%) IMT: ownership (public; private (common user); private); location (port city; regional; other city); function (terminal; container park; inland port) trains: ownership (public; private); competition (port-managed; laissez-faire; centralised; sole operator) track network: ownership (public; private (common user); private); access charges (subsidised; marginal; commercial; not applicable) port terminal: ownership (port; container terminals; train co; other); No. of terminals (one; two; several); sidings (on-dock; adjacent; distant) port management: ownership (public; private); role (landlord only; commercial player; within port; elsewhere) Intermodal system performance: commerciality (price-taker; price-setter; profitable); market share (low; medium; high); distance (0-30km; 30-100km; 100-300km; 300+ km); terminal quality (constrained; compartmentalised; efficient; seamless); integration level (fragmented; co-operative; integrated); links / transfers (many; some; few; none)	**Intermodal systems for Perth** – several research pieces • Review of key structural features of intermodal systems and inland ports in Australia and elsewhere • Estimation of potential intermodal freight demand in Perth, using trade data and Land Use activity databases • Restructure of commercial systems underpinning intermodal operations in Perth Outcomes to date: • Australian intermodal systems characterised by passive roles of port authorities. Future growth of intermodal share may require more imaginative commercial interventions • Short haul intermodal services benefit from high level of integration along the chain and will be commercially successful as large cities become more congested • Intermodal demand measurement across Perth industrial zones can be used to determine best locations for future terminals and inland ports • Any new container berths in Outer Harbour could feasibly be 'rail-only' connections to inland ports. **Supply Chain Trends** • Analysis of major global changes in supply chain systems and control, and their potential impacts on Perth • Likely impact of blockchain and computing developments on import/export supply chains Outcomes to date: • Owners of customer data will become increasingly important in controlling and shaping future international trade patterns • Consignment size is shrinking, raising problems for customs and taxation, and changing warehousing/logistics functions • Door to door order fulfilment creating many more small vehicle movements • Systems using blockchain technology will streamline certain elements of import/export trade, though not all • Physical impacts on actual logistics function in Perth will not be greatly affected by streamlined trading functions **Freight telemetry**	• Milestone 1 (Project Charter) • Milestone 2.1 Draft Report: Intermodal System Options and workshop • Milestone 2.2 Interim Report: Supply Chain Trends – literature review • Milestone 2.3 Interim report: Monitoring urban trucking – methodology) 

Research Questions and Policy Relevance	Findings to date	2018 Deliverables
	Application of BITRE software and methodology for detailed mapping of specific types of road freight activity to address road freight industry's policy concerns in Perth Outcomes to date • Open source mapping software has been obtained and BITRE methodology successfully applied • Some sample data has been acquired with which to test and demonstrate the freight route mapping in Perth CBD	
iMOVE CRC Project: Enhanced short and longer term network performance prediction capabilities through data-driven analytics and simulation		
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. • 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 	**Short term** (speed) prediction using data driven analytics (mathematical prediction using machine learning) as pre-emptive, early warning system of network failure • Achieving good predictions for freeways (best with VDS data, less so with GPS data) • Arterials - more difficult to predict, alternate GPS data sources used, some perform better than others **Longer term** prediction – network impacts of AV and CAV using Simulation – scenarios to determine upper and lower bounds, negative and positive impacts of an uncertain future for planning and management • Replicated Stern et al 's dissipation of stop and go traffic waves via control of a single AV • Applied simulation to a larger ring track, 2 lanes and range of AV penetration rates finding: • The more AV added, the worse the system performed (until 25% AV when we stopped the simulation) • Human factor responsible – human drivers cut in and changed lanes because of gap created by AV • Applied alterative driving model on Canning Highway- finding: • CAVs result in traffic improvements but, a significant market penetration rate is needed. Significant is the improvement which CAV made on arterials.	• Milestone 1 (Progress Report incorporating: Model selection based on literature review (Task 1.1); Data preparation (Task 1.2); Preliminary model testing (Task 1.3) • Milestone 2 Model selection based on literature review (Task 2.1)  
Smart Cities and Suburbs grant: RailSmart Wanneroo Planning Support System		
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. The project objectives are: • How do you optimize public transport infrastructure and usage? • How do you optimize the potential of job creation through the design of the built environment and bulk infrastructure investment (i.e. the railway development)?	Component tools incorporated in prototype platform: **Node – Place Analysis Tool** Investigates the train station precincts with respect to their Place, Node, and Background Traffic characteristics. This module considers various spatial resolutions (SA1, SA2, traffic zones), but the final output presents results aggregated at the precinct level (buffers of 0.8 or 1.6km radius around train stations). Shows the functioning of stations as physical built entities. It groups stations with similar characteristics and looks for common patterns for the groupings. The model aims to determine, based on the quality of the built area and it's functioning, how many passengers are likely to use public transport. **Travel Behaviour Tool** An evidence based, data-driven module centred on the analysis of SmartRider data. The module is divided	• First progress report (Establishment and RailSmart Planning Support System Design submitted to Commonwealth. RailSmart tender awarded – ARUP for platform development. • Second progress report (Adapt and Apply the RailSmart PSS as a proof of concept

Research Questions and Policy Relevance	Findings to date	2018 Deliverables
RailSmart 	into two complementary components: one focusing on macro analysis, investigating large scale patterns in the data, and the other on micro analysis, studying the travel patterns of individuals. The latter component is organised around three key entities in the Perth public transport network, namely, passengers, hubs and journeys. What this analysis shows us is the functioning of stations from the user perspective. It allows for the grouping of stations by predominant use type based on the length of time a passenger stays at a station. It also shows the directions people come from and how busy the station is in comparison to other stations. **Accessibility Tool** A detailed analysis of the accessibility of all employment nodes by private or public transport. This analysis seeks to work out how many jobs/ the population/or the number of dwelling units which are accessible within a given time period. It uses OpenStreetMap to calculate private transport and public transport route and timetable data to calculate public transport. The model calculates how many centre points of STEM Zones are accessible to the selected station using real road and rail network routes within a given time. In the example opposite, the different accessibility of Perth CBD via public and private transport is evident. The model works out the entire trip from the centre point of the STEM zone, so with public transport it also accounts for the time to reach the nearest public transit point. **Employment Analysis Tool** The purpose of this component of the project is to build on existing knowledge and data to provide meaningful means to measure and track the socio-economic variables in the City of Wanneroo, specifically jobs and employment. The jobs data is separated out into the strategic and population following employment. The argument being that a certain number of jobs (such as dentists, retail, teachers) are created simply by having a resident population; strategic jobs however, tend to generate a multiplier effect and follow the strategic strength of a location. In order to work out a competitive advantage of an area the location quotient has been used.	
Your Move Options Analysis (smaller, external project)		
Applying some of the analyses undertaken in the PATREC Projects (1 and 4.2 in 2017) to inform the DOT process to identify stations most suitable for Your Move behaviour change programs		Completed.
Video Analytics (smaller, external project)		
Feasibility assessment of using video analytics to identify and count vehicles from MRWA video footage	• Vehicle counting – accuracy levels: ○ Day time, average traffic flow: 98% ○ Night time: 95% ○ Rainy condition: close to 98% (light rain)	Completed. Next phase conceptualised.

Research Questions and Policy Relevance	Findings to date	2018 Deliverables
	○ Peak hour traffic: 97.8% • Vehicle classification by length • Speed estimation • individual vehicles • average speed by lane • Intersection turnings • Street light detection • Pedestrian & cyclist counting	
ARC Linkage "Rethinking integrated land-use and transport (LUTI) systems" (proposal submitted)		
The research will: 1) establish how superior LU and mode choice model parameters (and associated data development) will improve plans and policies; and 2) demonstrate that the performance of the LUTI model can remove barriers to adoption. The collaboration with POs will provide government agencies, planners and consultants with tools for realistic analysis of potential economic, social, energy and environmental effects of alternative urban development scenarios; testing spatial distribution of people and employment, and the impacts and wider benefits of investments in infrastructure and services. Developments here could be replicated elsewhere, as the project delivers the methodology.-		
Cycling Access to Stations – testing a pilot Planning Support System (proposal submitted)		
Planning for bicycle access to rail stations and rail station precincts increases opportunities for multi-modal travel and may provide a range of mobility and place-based benefits to the functioning of station precincts. This research project will develop a proof-of-concept Planning Support System (PSS) for cycling access to rail station precincts. The PSS will build on existing tools and draw upon local datasets to inform planning for rail station access and development planning in three stations on Perth's transport network. The PSS framework will be based on four domains important to bicycle planning – network characteristics, bicycle infrastructure quality, travel demand characteristics, and station precinct features, such as land use, employment opportunities and key spatial features. Data relating to each of these domains will be integrated and visualised via the PSS. The project is part of a larger Smart Cities project, and the findings will inform how PSS can allow planners to anticipate the needs of metropolitan growth areas. here is a clear need for more informed policy for cycling infrastructure investment and travel demand management aligned with Metronet.This project also has potential to provide support to PTA's Route Utilisation Strategy.		

2.2 New core project (2019-2021) selection process commenced

Planning for the new two-year program of integrated research for 2019-2021 commenced in July 2019 with the process clarification. Agency partners developed policy-relevant project concepts in response to a call with an indication of available core funds. Researchers responded with short proposals (20 proposals received) with a total budget estimation of around $2 million, more than double the amount available as PATREC core funds. The PATREC Research Advisory Committee considered the proposals, recommending to the Board: projects to be supported, those requiring further work required or those not supported. At the last Board meeting of the year, the Board approved seven projects for further scoping and detailed project plan development, with an indicative budget allocation of $1.245K over two years (Table

Table 2: Potential projects (2019-21 research program) identified for further development

Policy impact area	PATREC Potential New Projects (2019-21)	Agencies
Public transport travel optimisation – short and longer term	Optimising travel behaviour: short- and long term perspectives - Patronage trend analytics for demand forecasting and behaviour change strategies	DOT, PTA, DPLH
	Optimal journey planning and mode choice	
	Public confidence in the use and roll-out of shared, automated and electric vehicles	
	Transport impacts of residential land use proposals for redeveloping precincts	
Smart roads/congestion mitigation	Enhanced vehicle detection and simulation technologies for network performance prediction for early warning and network planning and management	MRWA, DOT, DPLH
Freight rail optimisation	Intermodal catchment demand estimation for intermodal system planning to optimise freight transport by rail	DOT, MRWA, DPLH
Transport infrastructure investment risk management coordination	Adapting portfolio-wide strategic infrastructure investment planning and management tools, guidelines and frameworks to account for emerging risks – appraisal, strategic asset management, simulation modelling	MRWA, DOT, PTA, DPLH

3 KNOWLEDGE TRANSFER

3.1 PATREC Connection Events

iMOVE CRC WA Projects launched on Tuesday 27 February 2018

PATREC and iMOVE CRC jointly hosted an informal celebration at The University Club, 4.30—6.00pm, to officially launch the first two WA projects:

- Enhanced short and longer term network performance prediction capabilities through data-driven analytics and simulation (project summary attached as Appendix 5A) – project agreement executed on 22 January 2018
- Planning intermodal and general logistics infrastructure for the future needs of Perth (project summary attached as Appendix 5B) – project agreement executed on 24 January 2018
- Welcomed Richard Sellers, Steve Beyer, Peter Woronzow as our special guests
- CEO of IMOVE, Ian Christensen and the Chair of the iMOVE Board, Ian Murray AO co-hosted the event
- Articles published on iMOVE website https://imovecrc.com/news-articles/freight-and-logistics/western-australia-first-two-imove-projects/

The Director gave presentations and participated in panel discussion at the following forums:

- Wanneroo Jobs Summit – Creating 100,000 jobs - 7 June 2018: Innovation, Smart Cities and Research & Development (Panel discussion)
- Social Impact Summit, UWA – 19 July 2018: Smart and Intelligent Cities – Places and Connections (Presentation)
- WALGA Sustainable Transport Forum – 1 August 2018: Sustainable transport policy: *Are "Smart" and "Intelligent" the new Sustainable?* (Presentation)
- Westport Thinkathon – 27 July 2018 (judging panel)
- AUDRC Provocations - 30 July 2018: Disruption and Adaptation - Harnessing the opportunities presented by disruptive transport technologies (Panel discussion).

PATREC is featured as part of new **UWA Public Policy Institute** (UWAPPI) established to be a bridge between academic research and government, public and business needs, delivering real-world policy impact. UWAPPI works on State and national issues, and also draws on UWA's distinct geographical advantage as Australia's Indian Ocean capital city to collaborate with neighbouring countries and their institutions to deliver policy solutions for the Indian Ocean Rim and the broader Indo-Pacific region.
https://www.uwa.edu.au/institutes/public-policy/Focus-areas/Cities-development-and-regional-policy

Next **State of Australian Cities (SOAC) Conference** in Perth in early December 2019: the joint UWA-Curtin bid to host the 2019 State of Australian Cities Conference has been successful. The Director is on the organising committee and will ensure that PATREC is featured and will also bring to the Board at a later stage, options for PATREC to provide support e.g. sponsorship of a theme, event, session.

PATREC hosted, presented at and participated in following **forums**:

- Korea – 15 November - The City of Perth is receiving a government delegation from their Sister City of Seocho, Korea as this year marks the 10th Anniversary of the signing of our Charter of Mutual Friendship with Seocho. One area of interest flagged by the delegation was the use of land and urban planning, transport policy and planning to meet the future needs to residents. PATREC (Linda Robson) hosted a one hour presentation by Associate Professor Doina Olaru and Associate Professor Rachel Cardell-Oliver, Dr Linda Robson and Mr Tristan Reed dealing with local experience on these issues.
- UWA hosted seminar – 16 October PATREC in collaboration with the Geography and Planning discipline, UWA hosted Dr Anders Larsson a visiting senior lecturer and Head of the Human Geography Unit in the Department of Economy and Society, School of Business, Economics and Law at the University of Gothenburg, Sweden. He presented a paper on social accessibility which was very well attended by a DoT and university audience.

- Australia Update Forum, 4th of September 2018, "Railsmart Planning Wanneroo" (Doina Olaru, Brett Smith) – poster presentation
- UWA, FABLE Town Hall Research Impact, 17th of September 2018, "Smart Cities – Preparing Wanneroo for 2050" (Doina Olaru, Brett Smith) – poster presentation
- Autonomous Bus UWA Open Day Trial, 18th of August, "Findings from the AV trial at UWA Open Day and the week after" (Doina Olaru and team)
- AITPM – corporate with AITPM to initiate an event to present four of UWA best students' work related to transport and traffic. Topics including P&R demand modelling, Road Maintenance Scheduling, AV modelling, SmartRider data analysis. It's intended to give students exposure to the industry and vice versa.

3.2 Research Outputs

The focus of PATREC's research outputs in 2018 was on the publication of key milestone reports for the iMOVE CRC and Smart Cities RailSmart Wanneroo projects (Table 3). Six peer-reviewed journal papers were published in 2018. A total of nine conference papers were presented with six published in proceedings. Six journal papers were submitted or re-submitted for publication (Table 4).

Table 3: Research Outputs in 2018

Publication Title	Author/s	Publication Date
RESEARCH PROJECT TECHNICAL REPORTS COMPLETED		
iMOVE 1-003 Enhanced short and longer term network performance prediction capabilities through data-driven analytics and simulation – **Progress Report 1**: ○ Model selection based on literature review (short term prediction) ○ Data preparation ○ Preliminary model testing ○ Model selection based on literature review (longer term AV impact)	Rui Wang, Yan Ji, Wei Liu, Chao Sun, Sharon Biermann	June 2018
iMOVE 1-003 Enhanced short and longer term network performance prediction capabilities through data-driven analytics and simulation – **Progress Report 2**: ○ Link level model development and calibration ○ AV driver behaviour model development ○ Scenario testing	Christopher Bartley, Yan Ji, Noah Lester, Wei Liu, Chao Sun, Mark Reynolds, Sharon Biermann	Dec 2018
iMOVE 2-001 Planning intermodal and general logistics infrastructure for the future needs of Perth – **Intermodal System Report:** ○ Options for Perth ○ Intermodal system structures for Perth ○ Intermodal demand projection for Perth	Tim Hoffman	Dec 2018
iMOVE 2-001 Planning intermodal and general logistics infrastructure for the future needs of Perth – **Supply Chain Trends Report** ○ Global trends ○ Applicability to Perth and Western Australia	Craig Standing, Susan Standing, Ferry Jie, Tim Hoffman	Dec 2018
RailSmart Planning Wanneroo – **Progress Report** - **Adapt** and integrate existing planning support technologies into the design of the RailSmart Planning Support System	Linda Robson, Sharon Biermann, Tristan Reed, Doina Olaru, Brett Smith, Kirsten Martinus, Rachel Cardell-Oliver, Chao Sun, Craig Standing, Susan Standing, Ferry Jie	June 2018

RailSmart Planning Wanneroo – **Progress Report** - **Apply** the RailSmart Planning Support System as a Proof of Concept	Linda Robson, Sharon Biermann, Tristan Reed, Doina Olaru, Brett Smith, Kirsten Martinus, Rachel Cardell-Oliver, Chao Sun, Craig Standing, Susan Standing, Ferry Jie, Sae Chi	Dec 2018
Your Move Station Options Analysis – **Final Report and Infographics**	Doina Olaru and Rachel Cardell-Oliver	Jan 2018
PEER REVIEWED JOURNAL PAPERS AND BOOK CHAPTERS PUBLISHED		
Standing, C., Standing, S., & Biermann, S (2018). The Implications of the Sharing Economy for Transportation, *Transport Reviews,* 39:2, 226-242		
Thai, V., Jie, F., (2018). The Impact of Total Quality Management and Supply Chain Integration on Firm Performance of Container Shipping Companies in Singapore. Asia Pacific Journal of Marketing and Logistics, 30(3), 605-626, United Kingdom, Emerald Publishing Limited, DOI: https://doi.org/10.1108/APJML-09-2017-0202.		
Wang, M., Jie, F., Abareshi, A., (2018). Logistics Capability, Supply Chain Uncertainty and Risk, and Logistics Performance: An Empirical Analysis of Australian Courier Industry. Operations and Supply Chain Management: An International Journal, 11(1), 45-54, OSCM.		
Ewedairo, K., Chhetri, P., Jie, F., (2018). Estimating transportation network impedance to last-mile delivery: A Case Study of Maribyrnong City in Melbourne. The International Journal of Logistics Management, 29(1), 110-130.		
Jabeen, F., Olaru, D., Smith, B. (2018). Combining samples to offset nonresponse and respondent biases, Case Studies on Transport Policy, 6, 190-199, https://doi.org/10.1016/j.cstp.2018.02.001.		
Maginn, P, Paul, V and Biermann, S (2018). Strategic spatial planning down under: evolution, governance and policy reality of strategic spatial plans in Australia. Territory and States (ed). Joaquin Farinos Dasi and Joaquin Farinos y Enrique Oeiro, pp 701-730.		
CONFERENCE PAPERS PRESENTED AND PUBLISHED IN PROCEEDINGS		
Braun, H. and Olaru, D. (2018). Understanding bid-price generation for road freight transport by analysing online market data, ATRF, 30 November-1 December, Darwin.		
Cardell-Oliver, R. and Povey, T (2018). Profiling urban activity hubs using transit smart card data, ACM International Conference on Systems for Energy-Efficient Built Environments, November 7-8, Shenzhen, China.		
Crisan, D, Olaru, D, Taplin, J, and Muhling, J (2018) Exposure to pollutants – contribution of daily activities, ATRF, 30 November-1 December, Darwin.		
Dallimore, J and Biermann, S (2018). Free Wi-Fi on public transport – will it make a difference to urban travel? ATRF, 30 November-1 December, Darwin.		
Greaves, S, Smith, B, Arnold, T, Olaru, D and Collins, A (2018). Autonomous Vehicles Down Under: An Empirical Investigation of Consumer Sentiment, ATRF, 30 November-1 December, Darwin.		
Olaru, O, Moncrieff, S, McCarney G, Reed, T, Sun, Y, Pattison, C, Smith, B and Biermann, S (2018). Place vs Transit Node: Policy Priorities Revisited, European Transport Conference, Dublin, 10-12 October.		
CONFERENCE PAPERS PRESENTED		
Huang, Y, Smith, B and Olaru, D (2018). Experimental Design of Stated Choice Tasks to Capture respondents' risk attitudes, 15th International Conference on Travel Behaviour Research. July 15-20, Santa Barbara, California.		
Smith, B, Olaru, D, Greaves, S and Collins, A (2018). To Share or Not to Share: A Best-Worst Analysis of Peer-to-Peer Carsharing in an Autonomous Future. 15th International Conference on Travel Behaviour Research. July 15-20, Santa Barbara, California.		
Greaves, S, Smith, B, Olaru, D and Collins, A (2018). What we Know: Evidence-based Behavioural Studies of Impact of Automated Vehicle Systems 3rd Automated Vehicles Symposium July 9-12, San Francisco, California.		

Table 4: Journal Papers Submitted, Re-submitted or accepted for Publication in 2018

Paper
McLeod S, Schapper, J.S.M, Curtis, C & Graham, G (2019) Conceptualizing freight generation for transport and land use planning: A review and synthesis of the literature, *Transport Policy*, 74, Feb, 24-34. ***Accepted.***
Pettit, C, Biermann, S, Pelizaro, C, Bakelmun, A (2018). A data driven approach to exploring future land use and transport scenarios: the Online What If? Tool. *Journal of Urban Technology*. ***Submitted.***
Taplin, J. and Sun. Y, 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*. ***Revision Submitted.***
Olaru, D., Smith, B., Tan, X., Pattison, C., Powell, L. (2018) Trialling an autonomous bus at the University of Western Australia: logistics, lessons and 'likes', *Transportation Research C.* ***Submitted.***
Clements, S., Olaru, D., Smith, B., and Boruff, B. (2018) Understanding the impact of agglomeration economies on commercial property prices, *Urban Studies.* ***Under review.***
Olaru, O, Moncrieff, S, McCarney G, Reed, T, Sun, Y, Pattison, C, Smith, B and Biermann, S (2018). Extending the Node-Place Model and Policy Implications, *Sustainability* (Special Issue). ***Submitted.***

3.3 Research Impact

3.1.1 Research Project Outcomes

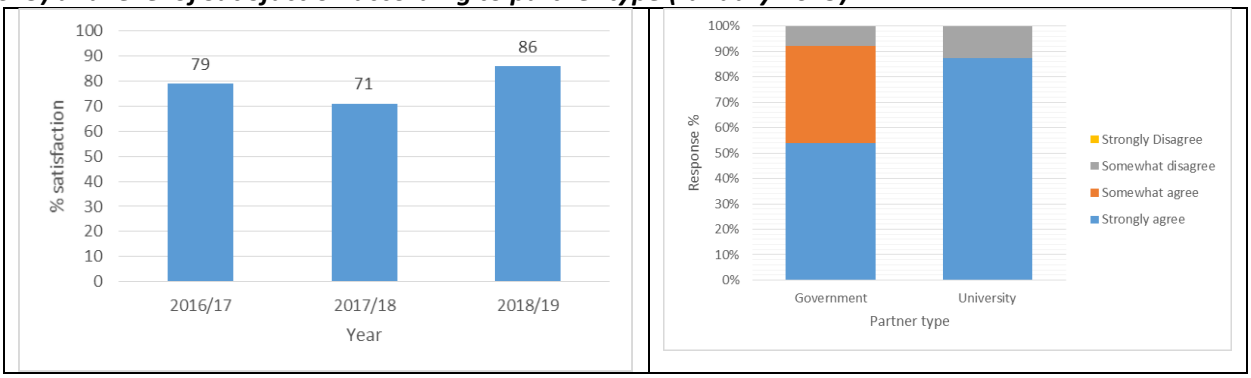
Most substantive projects were in progress during 2018 but one of the smaller project, completed earlier in the year, Your Move Options Analysis, received positive comments from the client, DOT:

- This project applied some of the analyses undertaken in the previously completed PATREC Projects (1 and 4.2, 2017) to inform the DOT process to identify stations most suitable for Your Move behaviour change programs
- "As you know, we were extremely satisfied with the work that Rachel and Doina completed for us recently on the Your Move Train Station Options Analysis" (extract from email from Zarin Salter, 22 February 2018)
- "We had a very in depth look at all the data again yesterday (and your fantastic visualisations) and while we've been able to whittle down our top choices of [stations] where to implement Your Move programs] …. we very much value the information and insights that your data analysis has provided us thus far and would be so grateful if you could do this one extra piece of additional paid work [a further station analysis] (extract from email from Zarin Salter, 22 February 2018)

3.1.2 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 December 2018/January 2019 survey, circulate to over 70 stakeholders directly involved in PATREC research (n=21), returned a percentage satisfaction rate of 86%. This is the highest satisfaction rate of the three years in which the survey has been run (Figure 1). Government partners had the highest response rate (n=13) with over 90% respondents strongly or somewhat agreeing that overall, they are satisfied with PATREC's performance. 88% of university respondents, strongly agreed that they are satisfied with PATREC's performance.

Figure 1: Trend in overall satisfaction with PATREC's performance (February 2017, January 2018, January 2019) and level of satisfaction according to partner type (January 2019)



4 TEACHING

Included in PATREC's mandate is to conduct teaching as well as research in the connected spaces of transport and land use planning. Teaching has not been a priority in the last 5-7 years, beyond presenting a few guest lectures. An opportunity to teach a Transport Policy and Planning unit as part of the Urban Planning Masters at UWA has arisen and discussions have commenced with the aim of teaching this unit in the 2nd semester 2019. Resourcing implications are being investigated and at the appropriate stage of development, it is the intention that a Board paper will be presented for Board consideration and decision, if necessary.

- Linda Robson teaching (paid by UWA): Geographies of a Global City, Urban Planning and Design, Geography and Planning and Practicum and Disasters! In 2018. In 2019, will lead Geography and Planning and Practicum and Urban Planning and Design
- Chao Sun teaching (paid by UWA): Taught one third of Transportation Engineering, Civil Engineering (postgraduate level). Topics covered: Traffic flow theory; Highway capacity and level of service; Transport modelling. From 2019, Chao has been appointed as unit coordinator and teach once a year for a semester (1st semester).
- The Masters in Urban and Regional Planning programme has had its accreditation from the Planning Institute of Australia extended until 2021 and the co-ordinator can now be pursue options to strengthen the course including the introduction of a Transport Policy and Planning unit.

5 PEOPLE AND RESOURCES

5.1 Staffing

The iMOVE CRC and Smart Cities projects have enabled some human resourcing stability to be ensured for the core PATREC team at least until 2020.

Research Project Manager

- Dr Linda Robson was appointed in the role of PATREC Research Project Manager (RailSmart Wanneroo)
- Appointed on a two year fixed term contract for 0.8 FTE with the other 0.2FTE to cover her teaching responsibilities being paid by the School, starting 1 April 2018
- Linda has lectured in urban planning at UWA over the past 4 years and brings strong project management, website development and management and urban planning research skills to PATREC

PATREC Research Fellows

Dr Chao Sun's current fixed term contract extended to June 2020

- iMOVE Network Operation and RAC Pulse of Perth lead
- Salary paid 100% by research project funding (iMOVE, Smart Cities, RAC pulse of Perth)

Dr Sae Chi – 18 month contract provided

- Transport Engineer/Economist, commenced 24 September, from Brisbane) – iMOVE Freight, RailSmart
- Salary paid 100% by research project funding (iMOVE, Smart Cities)

Director

- Ongoing contingent appointment awarded
- Director's salary now significantly funded by Smart Cities grant funding

Research Assistants

- Yan Ji (Computer Scientist, UWA) – RAC Pulse of Perth, iMOVE CRC Network Operations
- Dr Rui Wang (Computer Scientist, UWA) - iMOVE Network Operations
- Tristan Reed (Computer Scientist, Curtin) – RAC Pulse of Perth, RailSmart Wanneroo, iMOVE CRC Freight (truck tracking)
- Daniel Cowan (Computer Scientist, UWA) - iMOVE CRC Freight (truck tracking)
- Adriana Maria Nunez Picado (PhD urban planning/geography student) – RailSmart (employment tool)
- Cate Patterson (Smart Cities support, UWA)
- Dr Susan Standing (Business and Law, ECU)

PATREC involved a number of academics who are employed full time by partner universities but who participate on an in-kind basis to conceptualise and manage projects, direct research assistants, undertake research and identify opportunities (Table 5). Limited use is also made of consultants where relevant expertise is not available within the partner universities.

Table 5: PATREC Project Research Associates

PATREC Research Assoc.	Faculty/School/Centre	Uni.
E/Prof John Taplin	Business School	UWA
A/Prof Doina Olaru	Business School	UWA
Dr Brett Smith	Business School	UWA
A/Prof Paul Bergey	Business School	UWA
A/Prof Rachel Cardell-Oliver	Computer Science	UWA
Dr Wei Liu	Computer Science	UWA
Dr Jianxin Li	Computer Science	UWA
A/Prof Mark Reynolds	Computer Science	UWA
Prof Craig Standing	Business and Law	ECU
Dr Susan Standing	Business and Law	ECU
A/Prof Ferry Jie	Business and Law	ECU
Tim Hoffman	THAdvisory	Consultant

Table 6: Project Steering Committee Participation

Agency/Project	iMOVE Freight	iMOVE ITS	RailSmart
DPLH	John Chortis		Matt Selby
DoT	Steve Beyer Tim Collins (Westport) Anne Marie Brits		Brett Hughes Zarin Salter Trevor Buckenara Liam Heitson
MRWA	Gary Player	Kamal Weeratunga Steve Atkinson Graham Jacoby	
City of Wanneroo			Ian Martinus Steve Marmion Michelle Tovey

5.2 Finances

The 2018 year ended with a balance of just over $107K, higher than the budgeted $37K as a result of a higher than expected carry over from 2017 (Table 7). Income was $153K less than budget, with iMOVE income higher than expected but Smart Cities income lower than expected. PATREC office expenditure was under-budget due to not proceeding with the appointment of an office administrator. Expenditure on research projects ended largely on track, at only $20K under budget.

Table 7: Financial Summary for 2018

PATREC Income and Expenditure 2018	YTD Actual 31 Dec 18	Budget 2018	Variance Budget vs YTD Actual
INCOME			
WA Government Grants	240,000	240,000	0
Universities Sponsorship	180,000	180,000	0
iMOVE Commonwealth	197,858	75,000	122,858
iMOVE UWA	70,000	70,000	0
iMOVE ECU	0	5,000	5,000
iMOVE additional gov/industry	195,000	200,000	5,000
Smart Cities and Suburbs	436,500	600,000	163,500
Other Research Grants & Contracts	29,376	120,000	90,624
Accrued Interest	-2,457	10,000	12,457
Total Income	**1,346,277**	**1,500,000**	**153,723**
EXPENDITURE			
PATREC OFFICE	**165,988**	**200,000**	**34,012**
RESEARCH PROJECTS	**1,269,578**	**1,290,000**	**20,422**
Total Expenditure	**1,435,566**	**1,490,000**	54,434
YTD BALANCE	-89,289	10,000	99,289
Balance Brought Forward from 2017	**196,494**	**26,848**	169,646
CLOSING BALANCE (incl Balance B/F)	**107,205**	**36,848**	70,357

6 GOVERNANCE

6.1 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. Reece Waldock continued as the Independent Chair of the Board. Eric Lumsden was replaced by David Caddy, Chair of the Western Australian Planning Commission (Table 9). The Western Australian Local Government Association (WALGA) officially joined the Board with Ian Duncan as member. The PATREC Director is an ex officio member of the Board.

Table 9: PATREC Board Members

2017	*2018*
Adjunct Prof Reece Waldock, Independent Chair	Adjunct Prof Reece Waldock, Independent Chair
Mr Eric Lumsden, Chair, Western Australian Planning Commission	Mr David Caddy, 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 Steve Beyer, Acting 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
Prof Margaret Jones, Director, Office of Research and Innovation, Edith Cowan University	Prof Margaret Jones, Director, Office of Research and Innovation, Edith Cowan University
Prof Matthew Tonts, Pro Vice Chancellor/Executive Dean, Faculty of Arts, Business, Law and Education, 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
	Mr Ian Duncan, Executive Manager, Infrastructure, WALGA
Prof Sharon Biermann, Director PATREC	Prof Sharon Biermann, Director PATREC

6.2 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 Board on project level matters, allowing the Board to focus on strategic matters.

Mr Brett Hughes continued as Chair of the PRAC (Table 10) and Damien Martin was elected Deputy Chair during 2018.

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 (Deputy Chair)	Department of Planning
John Chortis	Department of Planning
Marty White	Public Transport Authority
Rebecca Lange	Curtin University
Greg Morrison	Curtin University
Craig Standing	Edith Cowan University
Ferry Jie	Edith Cowan University
Doina Olaru	The University of Western Australia
Brett Smith	The University of Western Australia

7 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. Performance to date against 2018 targets as set in the Annual Business Plan 2018, is summarised in Table 10.

Table 10: Performance against Targets 2018

Performance Indicator	Target 2018	Achieved 2018
Academic Performance Indicators		
Number of journal papers published	7	7
Number of peer-reviewed book chapters published		1
Number of peer-reviewed conference papers published in proceedings	8	6
Number of peer-reviewed books published		
Number of top-up sponsored PhD graduated		
Value ($) of [direct] external research funding secured (through PATREC account)	$1,070K	$905K
Value ($) of [indirect] external research funding secured (through individual partner university account)		$18K (ECU/iMOVE) $23K (UWA/Video analytics)
Policy Impact Performance Indicators		
Number of high impact, policy-informing projects/sub-projects completed (mostly 2 year projects)	3	2
Number of substantive Technical Reports/Working Papers published	3	7
Number of PATREC Perspectives published on PATREC website	2	0
Number of presentations at PATREC and other connection events*	10	10
Number of connection events arranged and held	4	4
Number of short courses, unit contributions presented	1	3
Stakeholder satisfaction indicator	80%	86%

- *Including conference presentations with no published paper in proceedings*