AUSTRALIAN RESEARCH COUNCIL
Discovery Projects
Proposal for Funding Commencing in 2021

DP

PROJECT ID: DP210102089

First Investigator: Dr Ben Beck

Admin Org: Monash University

Total number of sheets contained in this Proposal: 149

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Part A - Administrative Summary (DP210102089)

A1. Application Title

(Provide a short title. (Up to 75 characters, approximately 10 words).)

Sustainable mobility: city-wide exposure modelling to advance bicycling

A2. Person Participant Summary

(Add all people participating in this application as a Chief Investigator or Partner Investigator. The Chief Investigator/s must: not be undertaking a Higher Degree by Research during the project activity period; reside predominantly in Australia for the project activity period; and be an employee for at least 0.2 FTE at an Eligible Organisation, or be a holder of an honorary academic appointment (defined in the Glossary of the grant guidelines) at an Eligible Organisation.)

Number	Name	Participant Type	Current Organisation(s)	Relevant Organisation
1	Dr Ben Beck	Chief Investigator	Monash University	Monash University
2	Prof Christopher Pettit	Chief Investigator	The University of New South Wales	The University of New South Wales
3	Dr Meead Saberi	Chief Investigator	The University of New South Wales	The University of New South Wales
4	Dr Simone Zarpelon Leao	Chief Investigator	The University of New South Wales	The University of New South Wales
5	Dr Kerry Nice	Chief Investigator	Monash University, The University of Melbourne	The University of Melbourne
6	Prof Tarek Sayed	Partner Investigator	The University of British Columbia, Canada	The University of British Columbia
7	Prof Trisalyn Nelson	Partner Investigator	Arizona State University	Arizona State University
8	A/Prof Meghan Winters	Partner Investigator	Simon Fraser University, Canada	Simon Fraser University, Canada

A3. Organisation Participant Summary

(Add all organisations participating in this application. Refer to the Instructions to Applicants for further information.)

Number	Name	Participant Type
1	Monash University	Administering Organisation
2	The University of New South Wales	Other Eligible Organisation
3	The University of Melbourne	Other Eligible Organisation
4	The University of British Columbia	Other Organisation
5	Arizona State University	Other Organisation
6	Simon Fraser University, Canada	Other Organisation
7	BICYCLE NETWORK INCORPORATED	Other Organisation

A4. Application Summary

(Provide an Application Summary (which is used by the Minister to consider the application), focusing on the aims, significance, expected outcomes and benefits of this project. Write the Application Summary simply, clearly and in plain English. If the application is successful, the Application Summary will be used to give the general community

an understanding of the research. Avoid the use of acronyms, quotation marks and upper case characters. Refer to the Instructions to Applicants for further information. (Up to 750 characters, approximately 100 words))

This project aims to develop a world-leading platform for city-wide modelling of cycling exposure. This project will provide unparalleled insights into cycling exposure by combining multiple cycling data sources through the use of advanced spatial statistical and machine learning techniques. The expected outcomes of this project are a novel inventory of cycling infrastructure, a cycling route choice modelling system and robust predictions of cycling volumes on individual streets. This project will deliver a step change in cycling that will lead to increased cycling participation, enhanced safety, and improved infrastructure planning, thereby resulting in substantial gains in population and environmental health.

A5. List the objectives of the proposed project

(List each objective separately by clicking 'add answer' to add the next objective. This information will be used for future reporting purposes if this application is funded. (Up to 500 characters, approximately 70 words per objective))

Objective

Phase 1: To develop a detailed inventory of cycling infrastructure using deep learning methods of imagery data.

Objective

Phase 2: To collect novel GPS route data from cyclists and combine these with detailed spatial data to develop a model of the routes that cyclists choose. This model will subsequently be applied to travel survey origin-destination data.

Objective

Phase 3: To develop a platform for modelling city-wide cycling exposure. This will be achieved by combining infrastructure data from Phase 1, unadjusted bicycle counts from travel survey data from Phase 2, with crowd-sourced and other spatial data to predict known bicycle count data.

A6. National Interest Test Statement

(Outline the extent to which the research contributes to Australia's national interest through its potential to have economic, commercial, environmental, social or cultural benefits to the Australian community. Write the description of the national interest simply, clearly and in plain English between 750 and 1125 characters (between approximately 100 and 150 words.)
Note: The National Interest Test Statement may also be used for public release by the ARC.)

Cycling has numerous health, environmental and social benefits, through factors such as reduced traffic congestion and air pollution, and by promoting an active lifestyle which in turn improves population health.

How safe someone feels when riding a bicycle is the major barrier to increased cycling participation. Therefore, providing protected cycling infrastructure (such as bicycle lanes that are physically separated from traffic) has the power to increase the number of people who ride bikes. However, there is a complete absence of detailed data related to where and when people cycle.

In this project, we propose to develop a platform that will enable us to model the number of cyclists on each road in a city. This will enable us to address significant knowledge gaps in cycling safety, identify areas in which we need enhanced cycling infrastructure and enable us to evaluate the effectiveness of existing infrastructure. Overall, we anticipate the use of these data will result in improved safety for cyclists, lower injury rates, increased cycling participation and reduced inequities.

Part B - Classifications and Other Statistical Information (DP210102089)

B1. Does this Application fall within one of the Science and Research Priorities?

Yes

Science and Research Priority	Practical Research Challenge
Transport	Improved logistics, modelling and regulation: urban design, autonomous vehicles, electrified transport, sensor technologies, real time data and spatial analysis.

B2. Field of Research (FOR)

(Select up to three classification codes that relate to the application. Note that the percentages must total 100.)

Code	Percentage
120506 - Transport Planning	100

B3. Socio-Economic Objective (SEO-08)

(Select up to three classification codes that relate to the application. Note that the percentages must total 100.)

Code	Percentage
880107 - Road Passenger Movements (excl. Public Transport)	40
880109 - Road Safety	30
920499 - Public Health (excl. Specific Population Health) not elsewhere classified	30

B4. Interdisciplinary Research

(This is a 'Yes' or 'No' question. If you select 'Yes' two additional questions will be enabled:
1. Specify the ways in which the research is interdisciplinary by selecting one or more of the options below.
2. Indicate the nature of the interdisciplinary research involved. (Up to 375 characters, approximately 50 words))

Does this application involve interdisciplinary research?

Yes

Specify the ways in which the research is interdisciplinary by selecting one or more of the options below.

Investigatory Team
Methodology

Indicate the nature of the interdisciplinary research involved. (Up to 375 characters, approximately 50 words)

We are an interdisciplinary team with expertise in cycling safety, transport modelling, spatial analyses, injury, engineering, urban design, computer vision, machine learning, and citizen science. CIs and PIs have a vast array of backgrounds, experience and expertise to address a critical knowledge gap in cycling safety.

B5. Does the proposed research involve international collaboration?

(This is a 'Yes' or 'No' question. If you select 'Yes' two additional questions will be enabled:
1. Specify the nature of the proposed international collaboration by selecting one or more of the options below.
2. Specify the countries which are involved in the international collaboration.)

Yes

B6. What is the nature of the proposed international collaboration activities?

(Select all options from the drop down list which apply to this application by clicking on the 'Add' button each time an option is selected.)

Correspondence: eg email; telephone; or video-conference
Face to face meetings

B7. If the proposed research involves international collaboration, please specify the country/ies involved.

(Commence typing in the search box and select from the drop-down list the name of the country/ies of collaborators who will be involved in the proposed project. Note that Australia is not to be listed and is not available to be selected from the drop-down list)

Canada
United States of America

B8. How many PhDs, Masters and Honours that will be filled as a result of this project?

(For reporting purposes, the ARC is interested in reporting the number of Research Students that would be involved in this application if it is funded. Please enter the number of student places (full-time equivalent) that will be filled as a result of this project.)

Number of Research Student Places (FTE) - PhD

1

Number of Research Student Places (FTE) - Masters

0

Number of Research Student Places (FTE) - Honours

0

Part C - Project Eligibility (DP210102089)

C1. Medical Research

(This is a 'Yes' or 'No' question. Does this project have content which requires a statement to demonstrate that it complies with the eligible research requirements set out in the ARC Medical Research Policy located on the ARC website?)

No

C2. Medical Research Statement

(If applicable, justify why this project complies with the eligible research requirements set out in the ARC Medical Research Policy located on the ARC website. Eligibility will be based solely on the information contained in this application. This is the only chance to provide justification and the ARC will not seek further clarification. (Up to 750 characters, approximately 100 words))

C3. Current Funding

(Does this application request funding for similar or linked research activities, infrastructure or a project previously funded, or currently being funded, with Australian Government funding (from ARC or elsewhere)? This is a 'Yes' or 'No' question. If 'Yes', provide the Project ID(s) and explain how funding this project would not duplicate Australian Government funding or overlap with existing projects.)

No

If yes, provide the Funded Project ID

Detail how this project is different from the previously/currently funded project(s). (Up to 2000 characters, approximately 285 words)

C4. Other Application(s) for funding

(Are you applying for funding from the Australian Government (ARC or elsewhere) for similar or linked research? This is a 'Yes' or 'No' question. If 'Yes' provide the application ID(s) and explain why more than one application for similar or linked research has been submitted.)

No

If yes, provide the application ID

Briefly explain why more than one application for similar or linked research has been submitted. (Up to 2000 Characters, approximately 285 words)

Part D - Project Description (DP210102089)

D1. Project Description

(Upload a Project Description as detailed in the Instructions to Applicants and in the required format. Ensure that the Project Description responds to the Assessment Criteria listed in the grant guidelines. (Up to 10 A4 pages))

Uploaded PDF file follows on next page.

D1—Project Description

PROJECT TITLE

Sustainable mobility: city-wide exposure modelling to advance cycling participation and safety

PROJECT QUALITY AND INNOVATION

Overview

The bicycle is the sustainable mode of transport of the future. Cycling as an active mode of transport has numerous environmental, social and health benefits, as a consequence of reduced traffic congestion, considerably reduced transport emissions and by promoting an active lifestyle which in turn improves population health.[1-3] However, the absence of detailed bicycle mobility data has severely limited our ability to progress cycling as a mode of transport. Specifically, the lack of cycling exposure data hinders our ability to evaluate cycling policies and interventions, identify areas in need of enhanced infrastructure, improve cycling safety, and plan for increasing urbanisation.

In this project, **we aim to develop a universal platform for city-wide modelling of cycling exposure that can be applied globally.** We will combine multiple data sources using novel statistical and machine learning techniques to provide unparalleled insights into cycling exposure (volume of cyclists on individual streets). Specifically, we aim to develop new city-wide inventories of cycling infrastructure (Phase 1), develop route choice models and apply these to travel survey data (Phase 2), with the overall objective of combining these data in a platform that will deliver validated city-wide bicycle volume data (Phase 3). To achieve these aims, we bring together an internationally eminent team of experts in transport modelling, cyclist safety and ridership, and machine learning. The diverse and complementary skills of this team are essential to addressing this significant societal challenge and delivering globally novel insights into cycling exposure.

This project will, for the first time, enable the global research community to significantly advance knowledge of the effectiveness of cycling infrastructure, the identification of areas in need of enhanced cycling infrastructure, critical measures to improve cycling safety, and opportunities to reduce inequities in cycling participation. The application of the study findings will not only result in improved safety for cyclists but importantly, promote wider uptake of cycling as a mode of transport, thereby leading to substantial gains in population and environmental health.

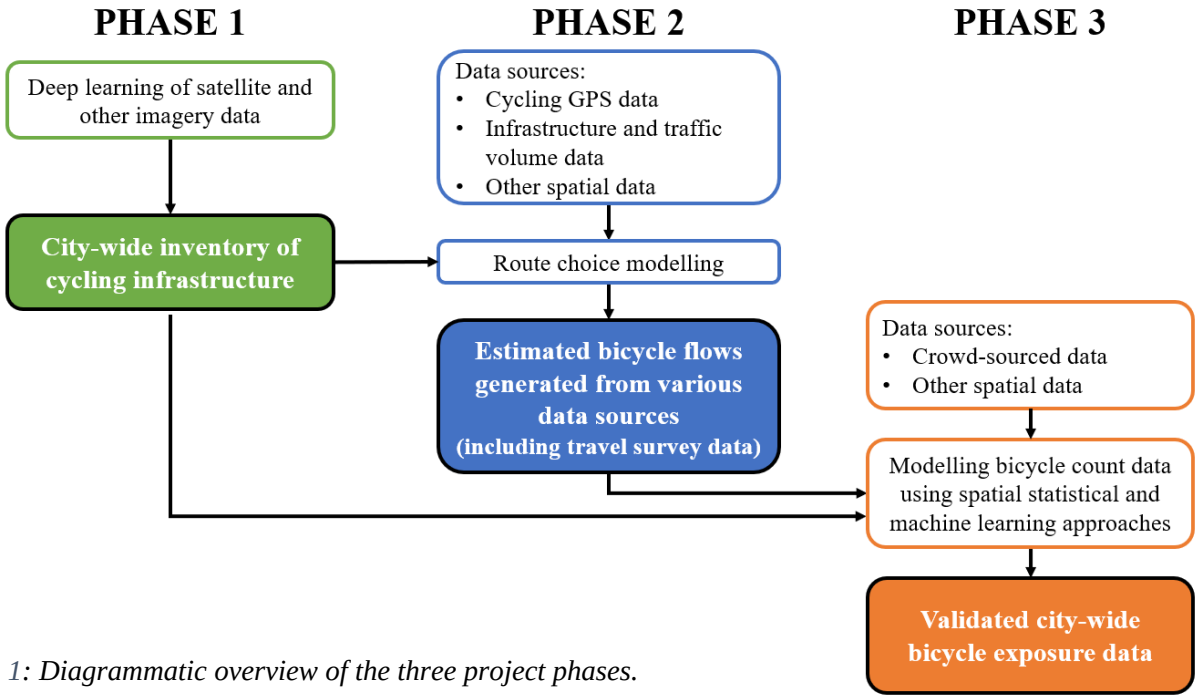

Figure 1: Diagrammatic overview of the three project phases.

Significance

Globally, cities are facing challenges of continued population growth and increasing demands on transport systems. Existing land use and transport policies negatively impact health through reduced physical activity, injuries, noise, stress and air pollution.[4] Further, the transport sector is a major contributor to climate change pathways, accounting for 25% of global carbon dioxide emissions; 75% of which arise from road transport.[5] As a result, Governments are increasingly emphasising the need for policies that encourage walking, cycling and public transport; policies that have been demonstrated to substantially improve the health of populations.[6] For example, commuting to work by bicycle is associated with a 41% lower risk of all-cause mortality and 45% lower risk of cancer incidence.[1] In

Deloitte's recent Technology, Media & Telecommunications Predictions 2020 report, the bicycle is listed as the second most important technological innovation. It is predicted that tens of billions of additional bicycle trips per year will occur by 2022.[7] Importantly, across the globe, transport policies are advocating for a modal shift towards cleaner, safer and affordable active modes of transport.[8-9] Although a number of Australian state government policies advocate for increased cycling participation,[10] only a small fraction of transport trips in Australian cities (e.g. 1% of trips in Melbourne) are by bicycle.[10] Given the potential benefits of such a mode shift, there is an urgent need for knowledge that can support increases in sustainable transport across Australia and internationally.

The major barrier to increased cycling participation is perceived safety (i.e. how safe someone feels when riding a bicycle).[11] It is well known that the provision of designated cycling infrastructure is critical to overcoming this barrier.[12-13] Improving cycling infrastructure has the power to shift mobility to active modes of transport, change the way we move about our cities and improve the health of our population and the environment.[14] However, effective decision making on where to invest cycling infrastructure for the greatest impact cannot be achieved in the absence of cycling exposure data (defined as bicycle volume data on individual street segments). As noted in the Victorian Cycling Strategy 2018-28, there is a complete absence of detailed data related to where and when people cycle.[10]

Urban mobility data is critical to understanding travel patterns, to plan and evaluate policies and interventions, and to quantify health, environmental and social benefits. The absence of cycling exposure data has prevented evaluation of the effectiveness of interventions (including economic benefits), limited our ability to monitor the performance of the network, hindered our ability to identify areas in need of enhanced cycling infrastructure and prevented a robust understanding of cycling safety. Cycling infrastructure is therefore often implemented without strong evidence of the effectiveness of specific infrastructure types (e.g. on-road painted bicycle lanes) and the location of where to implement these treatments. This is in contrast to detailed motor-vehicle based traffic volume data that critically informs planning and operations over the short, medium and long term. These models have been used to optimise the structure of the network, evaluate the effectiveness of road safety interventions, improve journey planning and network operations, and plan for future growth of cities. **The absence of equivalent volume data for cycling has severely limited our ability to progress cycling globally.**

Traditional sources of cycling data and route information include manual and automated bicycle counts, travel surveys and questionnaires.[15] Each has their own intrinsic limitations, and often lack the spatial and temporal detail needed for monitoring cycling networks. For example, manual and automated bicycle counts are often inconsistent and scarce, or counts take place on specific cycling promotion days and are thus not representative of cycling participation. Furthermore, while travel surveys capture travel choices at a population-level, they often lack routing information and cannot generate cycling volume data at an individual street level. The use of novel data sources, including crowdsourced data from smart phone apps and automated counting of cyclists in video data, has the potential to provide new insights into where and when people ride. Additionally, as a key component of modelling cycling safety, there is need for accurate data on city-wide cycling infrastructure. Research conducted by CIs Beck and Saberi and PIs Sayed and Winters demonstrates the critical role that cycling infrastructure has on safety.[16-20] However, inventories of cycling infrastructure, such as those generated by transportation agencies, are often out-dated and missing critical detail (e.g. protected bicycle lanes vs. shared lanes).[21] The growing availability of imagery data, such as satellite and street level imagery, and capabilities of computer vision and machine learning provide a highly novel opportunity to develop detailed city-wide inventories of cycling infrastructure.

Globally, there are few city-wide spatial and temporal models of cycling volumes. Exemplary efforts include those developed by PI Sayed in Vancouver, Canada,[22] PIs Nelson and Winters in Victoria, Canada,[23] and the 'Cynemon' model developed by Transport for London. Such models have been used to evaluate the effectiveness of cycling infrastructure,[24] evaluate bike network structure,[19] identify crash hot spots (accounting for exposure),[25] and enable planning for future cycling demand.[26] However, to date these models can only predict cycling volumes on a limited set of street segments within a city,[22] or have inadequate predictive accuracy,[23] and rely on single sources to predict cycling volumes (e.g. only crowd-sourced data or manual and automatic counts).

Thus, in this project, our aim is to develop a universal platform that generates detailed city-wide inventories of cycling infrastructure and cycling volumes by combining multiple traditional and non-traditional data sources. We will develop and validate this platform using Melbourne, Australia, as a case study, and validate this approach in Phoenix, USA (with PI Nelson). The world-leading platform developed in this project will provide critical insights into cycling volumes at the street-level. This capability addresses a substantial knowledge gap in cycling and will enable us to, for the first time, develop evidence-informed policy, evaluate cycling infrastructure and interventions, and prioritise cycling infrastructure investments. Additionally, by understanding cycling infrastructure and participation at the neighbourhood-level, we can identify areas with inadequate cycling infrastructure and access to services, and identify areas of low cycling participation. This will enable focus on areas of low participation and will ensure equitable distribution of cycling infrastructure. Overall, this will lead to improved safety for cyclists, greater

equity and a substantial increase in the number of people riding bikes, therefore realising the potential for huge gains in population and environmental health.

Approach and Method

The central goal of this project is to develop a universal platform for modelling cycling exposure. To achieve this, a three-phase program will be undertaken (Figure 1). Phase 1 will employ deep learning methods of imagery data to develop a highly detailed database of cycling infrastructure. Phase 2 will use infrastructure data from Phase 1, other spatial datasets and GPS data collected from bicyclists to develop a novel model of cyclists' route choices. This model will be applied to population-weighted travel survey data to develop estimated cycle volumes. These estimated volumes will be combined with known volumes from a large crowd-sourced social network, Strava, as inputs into the model of cycling volumes. In Phase 3, two modelling approaches will be implemented to develop a model that most accurately predicts known cycling counts, using Melbourne as a case study. Melbourne is selected as the case study city as the majority of the data (satellite imagery, travel survey data, spatial data, crowd-sourced data) are available, the city is undergoing rapid urban growth and the proportion of trips made by bicycle is low, therefore provide an opportunity for substantial modal shift. The model will then be applied to and validated in Phoenix, USA. The following is structured as an overview of the methodological approach to the development of the framework, followed by a section on the data sources.

Phase 1: Deep learning of imagery data to develop a detailed inventory of cycling infrastructure

CIs Beck and Saberi and PIs Sayed, Nelson, and Winters have demonstrated the importance of cycling infrastructure on cyclists' safety and where cyclists choose to ride.[12-13,15-17] However, current inventories of cycling infrastructure, such as that held by transportation agencies (e.g. Victorian Department of Transport; DoT) or through mapping products (e.g. OpenStreetMap) are often out-dated and/or missing critical information. For example, the Victorian DoT inventory of cycling infrastructure was last updated over three years ago. Additionally, these inventories are often missing critical details of cycling infrastructure, such as the lane type and the lane width. With the increasing accessibility of detailed imagery data (such as satellite and street level imagery), it is now possible to use computer vision and machine learning techniques to extract this information directly from this imagery.

Methods

The main data source will be satellite imagery from Nearmap. Imagery from Google Street View will be used as supplementary data for locations that are obscured by trees and other overhead obstructions. Identification of road features from satellite imagery through computer vision techniques has previously been used[27-28] and a range of these (and others) will be applied to catalogue cycling infrastructure. CI Nice has extensive experience in these methods and the application to cycling.[29-30] First, the non-road areas will be masked out to eliminate unnecessary data using the PSMA Street Network and the land cover data from Geoscape. Line markings (to enable the quantification of bicycle/traffic lanes and lane widths) will be extracted through Canny edge detection/Hough transforms. Mean shift or superpixel classification will assist in identifying sections of road paint (i.e. green bike lanes). Neural network semantic segmentations will also be used in conjunction with these techniques. Obscured areas will be identified and similar techniques will be applied to supplementary imagery to fill in the gaps. A validation of the accuracy of this method to fill gaps will be enabled through the higher resolution imagery and 3D point cloud/canopy data from the City of Melbourne. The outcome of Phase 1 will be a feature map of the city's bicycle infrastructure that will include the infrastructure type (e.g. protected bicycle lane, marked on-road bicycle lane, sharrow, off-road path) and important characteristics of the road/bicycle lane (such as green paint, lane width).

Phase 2: Route choice modelling to develop estimated cycle volumes

PI Winters has demonstrated that cyclists often do not take the shortest path between an origin and destination, and preferentially choose to travel along local roads, off-street paths and routes with bicycle facilities.[13] However, Australian data on the routes that cyclists choose are lacking. We will draw from the experience of CIs Pettit, Leao and Saberi[31-33] and PIs Sayed[34] and Winters[13] who have substantial experience in modelling the routes that cyclists choose. In Phase 2, we will firstly collect GPS route data from a cohort of cyclists. This route data is then paired with bicycle infrastructure data generated in Phase 1 and other spatial data. Based on these data, a route choice model is developed. The parameters from the route choice model will be applied to origin-destination data from population-weighted travel survey data to generate population-wide crude estimates of cyclist volumes along street segments.

Methods

Data sources: We will use GPS route data from a cohort of cyclists specifically recruited for this project (n=2,500) and bicycle infrastructure data generated in Phase 1. This will be combined with other spatial data that reflect key factors that our team have demonstrated are often associated with the routes that cyclists select and will be considered in the route choice model, including: the presence of cycling infrastructure, number of traffic lanes, traffic volumes,

the presence of on-street parking, topography, land use and green space.[13,31-32,34] Further details of all data are outlined in subsequent sections.

Route choice model: A number of major challenges exist in developing a route choice model using revealed preference (RP) data including identifying the available route alternatives for each observed trip by individual travellers which requires systematic, restricted or unrestricted, generation of a set of unchosen alternatives. Further, classical discrete choice modelling techniques (e.g. multinomial logit) used to understand route choice often suffers from violation of the Independence of Irrelevant Alternatives (IIA) property due to overlapping routes in the collected RP data from GPS traces.[35-36] A cycling route choice model should account for the unobserved attributes of the overlapping routes. A number of techniques exist in the literature that account for this correlation including path size logit, cross-nested logit, paired combinatorial logit[36-37] and more recently proposed link-based recursive logit (RL).[38] The link-based RL model can be formulated as a sequence of link choices and falls under the category of dynamic discrete choice models.[39] In this project, we adopt a similar framework in which the instantaneous random utility for each individual traveller n of a link a conditional on state k can be defined as

$$u_n(a|k) = v_n(a|k) + V_n^d(a) + \mu\varepsilon_n(a)$$

where $u(.)$ and $v(.)$ represent the random and deterministic utility functions, respectively; $V_n^d(a)$ represents the maximum expected utility of link a to destination d; and $\varepsilon_n(a)$ represents the error term with a scaling parameter of μ. Therefore, the probability of choosing any link a given state k going to destination k can be formulated as multinomial logit model as expressed below. Note that the utility of a route is therefore the sum of the utility of each link in the route.

$$P_n^d(a|k) = \frac{exp\left(\frac{1}{\mu}v_n(a|k) + V_n^d(k)\right)}{\sum_{\acute{a}} exp\left(\frac{1}{\mu}v_n(\acute{a}|k) + V_n^d(\acute{a})\right)}$$

A further challenge to be explored is the scalability of such an approach when applied to a large-scale network given the number and size of the routes. To address this challenge, we will adopt and further develop a recently proposed decomposition technique by Mai *et al.*[40]

Estimating bicycle flows from origin-destination travel survey data: To generate estimated bicycle flows across the network, we will use data from the Victorian Integrated Survey of Travel and Activity (VISTA), which provides population-weighted estimates of trip origin and destinations (O-D) for all travel modes. Similar to work by CI Saberi,[41] we will apply the parameter estimates for route characteristics from the route choice model to the bicycling O-D data. The output will be crude estimated bicycle volumes on each road/path segment in Melbourne.

Phase 3: Development of a model of cycling exposure

In Phase 3, we will develop a platform for modelling city-wide cycling exposure, building on Phase 2. Here, we will combine infrastructure data (Phase 1), crude bicycle volume data from travel surveys (Phase 2), crowd-sourced data and other spatial data to predict known bicycle count data. The model will be validated by using 80% of the known count data for development, and 20% for testing. The platform will enable us to develop robust estimates of cycling volumes on each road/path segment, using Melbourne as a case study. The model will be validated in Phoenix, USA, to assess generalisability and scalability in cities outside of Australia, and demonstrate international application of the platform. PI Nelson is based in Phoenix and has access to all relevant crowd-sourced, travel survey and count data.

In this objective, we will compare both **spatial statistical** and **machine learning models** to identify the most robust approach for predicting bicycle volumes. Traditionally, spatial statistical models have been used to estimate bicycle and traffic volumes.[22-23,34] However, there is growing interest in machine learning, and particularly deep learning, as a novel method for modelling traffic volumes.[42] Given the paucity of bicycle exposure research, it is unknown as to which modelling approach generates the most accurate predictions; we will address this knowledge gap by applying both approaches in our case study.

Methods

Phase 3 aims to develop robust predictions of known bicycle count data. For this validation study, the count data will be sourced from: automatic counters (provided by the Victorian DoT), and from a cutting-edge machine learning computer vision method (developed by CI Beck) applied to closed circuit television (CCTV) camera streams. In Phase 3, we will use four groups of independent variables: infrastructure (from Phase 1), estimated counts from travel surveys (from Phase 2), Strava and additional spatial data. In both models, the dependent variable will be the known bicycle counts. Spatial data (details below) will include land use, road/bicycle infrastructure (including measures of bicycle network connectivity)[17] and traffic volume data from Phases 1 and 2, supplemented with Census data (socioeconomic data; e.g. household income, level of education, age and sex distribution) and historical weather

data.[43] Similar to CI Beck's previous modelling,[44] we will use an area of Greater Melbourne as a case study for validation purposes, with 57,285 street segments. For both models, we plan to use a random selection of 80% of the bicycle volume data as the training data (300 locations) and 20% as testing data (76 locations). Volumes will be modelled by weekday/weekend, peak/off-peak, and will account for seasonality.

Spatial statistical model: Drawing from the work of PIs Sayed, Nelson and Winters,[22,43,45] we will develop a novel statistical model that will create adjustment factors for both the estimated bicycle volumes and the Strava data based on the observed bicycle count data (in locations where count data are available). These adjustment factors will be applied to the estimated bicycle volumes (Phase 2) and the Strava data on each road segment to create a city-wide model of cycling volumes. We will employ a spatiotemporal Empirical Bayes (EB) model with the observed bicycle count data as the dependent variable, and the estimated bicycle volumes, Strava data, and spatial data as independent variables. The EB methodology is considered one of the most robust approaches for assigning weights and draws strength from 'neighbour links'; links (or segments) that are located within the same area type, have similar characteristics and have spatial correlations between observed counts. Model parameter estimates developed where observed count data are available will then be used as adjustment factors to be applied on road segments without observed count data.

Machine learning model: Deep learning models, such as artificial neural networks (ANNs), are considered to be one of the most cutting-edge artificial intelligence (AI) techniques. The strengths of ANNs include their flexibility and ability to model complex relationships, particularly in the presence of nonlinearity and inconsistent/noisy data. Such approaches have been employed by CI Saberi,[46] PI Sayed[45] and our Monash University collaborator, Professor Le Hai Vu.[42] We will employ a multi-layer neural network with several interconnected layers of neurons, including input neurons (estimated count data from Phase 2, Strava data, spatial data) and output neurons (known bicycle count data). The links that connect the neurons have numeric weights; these weights can be adjusted using a learning algorithm to learn the relationship between estimated bicycle volumes, Strava data, spatial data and observed count data.

Model assessment and measures of precision: As employed previously by our team, we will use three model evaluation measures to compare predicted bicycle volumes to known volumes: the mean absolute percentage error (MAPE), the Geoffrey E. Havers (GEH) statistic and the hit ratio.[22] Quality indices will be generated to reflect the measure of the precision of the volume estimate. The predicted confidence/credible interval is more informative if the interval is narrower. In line with best practice, we will use the ratio of confidence/credible interval width-to-volume.[47] We may also model categorical counts, rather than continuous counts, as our team has done previously.[23]

Validation in Phoenix, USA: Here, we will draw from prior work by PIs Nelson and Winters.[43] PI Nelson is based in Phoenix, USA, and has access to Strava, travel survey and count data. The model developed using Melbourne as a case study will be applied to Phoenix data, with model accuracy quantified using the aforementioned measures.

Data sources

Phase 1 (inventory of cycling infrastructure) data sources

Nearmap: Satellite imagery will be acquired from Nearmap, harnessing Monash University's Nearmap license. This provides complete coverage of Greater Melbourne at a 7.5cm resolution and is updated regularly (≥five times yearly).

Google Street View: We will use an existing framework for extracting Google Street View data developed by CI Nice.[32] For each selected location, four images will be retrieved at 0, 90, 180 and 270 degrees and as 640x640 tiles.

City of Melbourne data: Open-access data sets from the City of Melbourne (encompassing 37 km^2 of the study area) will be used. These include false colour aerial imagery (at 5cm resolution) and spatial polygons of tree canopies to validate the project's identification and removal of vegetation obstructions in the wider study area. The City of Melbourne also provides a 3D point cloud (at 7.5cm resolution).

Phase 2 (route choice modelling) data sources

GPS data: Our collaborator, Prof Mark Stevenson (University of Melbourne) has developed an iOS and Android application that accesses GPS coordinates and maps individual motor vehicle trips. We will leverage this platform and customise this app for cycling-specific trips. Cyclists will be asked to record each ride and the trip purpose. Cyclists will be recruited from our partner organisation, Bicycle Network, Australia's largest cycling membership organisation (45,000+ members), and Monash University and the University of Melbourne social media accounts. Similar approaches used by CI Beck to recruit cycling participants have been highly successful.[17] We will aim to recruit 2,500 individuals to capture their trips over a one week period. Purposive sampling may be required to ensure geographical coverage of Melbourne. Participant recruitment will occur over a 9-month period to ensure data coverage across seasons. As has been implemented by CI Beck,[17] we will use probabilistic map matching to align GPS traces to the road/path network using the ST-matching method. 100m buffers will be applied to trip origin and destination to maintain individual privacy.

Road infrastructure and traffic volume data: The Victorian road network shapefile will be sourced from the Victorian Department of Environment, Land, Water and Planning, which classifies the road type (arterial, sub-arterial, collector, and local roads) and number of traffic lanes. Speed zone, signals, and the presence of on-street parking will be sourced from the Victorian DoT. Topography data will be sourced from PSMA Australia. These data will be accessed through DataVic (Victoria's open data platform) and the Australian Urban Research Infrastructure Network (AURIN). Traffic volumes will be sourced from DynaMel; an open-source dynamic model of traffic volumes in Melbourne developed by CI Saberi.[33] We will use bicycle infrastructure data developed in Phase 1.

Land use data: Land use data and green space data will be sourced from PSMA Australia (through AURIN).

Travel survey data: The Victorian Integrated Survey of Travel and Activity (VISTA) is an ongoing survey of household travel and activity conducted on behalf of the State Government of Victoria. Data are collected from households in Melbourne, and select regional centres. A travel diary is completed by all household members each day over 12-months. The most recent VISTA data (2018) is based on ~6,000 households (representing ~15,000 people) weighted to represent the population of Melbourne. The data provide population estimates of trip origins and destinations (O-D) for all modes of travel. O-D data for Statistical Areas Level 1 (SA1, average population size of 400) will be provided by the Victorian DoT at no cost.

Phase 3 (model of cycling exposure) data sources

Strava cycling volumes: Strava is a social network for cyclists and runners. A mobile app is used to track activities with aggregate and de-identified data provided by Strava Metro. Data provided will be flow volumes through network nodes (intersections) and street segments for each hour of each day of the week, and counts within origin and destination polygons. Strava have indicated that there are approximately 3 million trips made by 73,000 Strava users yearly in metropolitan Melbourne. Strava are providing these data at no cost (cost saving of $87,000).

Weather data: Daily temperature and rainfall data will be sourced from the Bureau of Meteorology (gridded dataset).

Census data: Based on prior factors identified by PIs Nelson and Winters,[43] we will use the Australian Bureau of Statistics Census data at a small area level (SA1) for measures of socioeconomic level (Socioeconomic Indexes for Areas (SEIFA), household income, level of education), age and sex.

Automatic bicycle count data: The Victorian DoT currently has 42 off-road and 4 on-road automatic bicycle counters, which are a combination of pneumatic hose counters and permanent inductive loop counters. These counters continuously record data and the data are made publicly available.

CCTV bicycle count data: Given the relatively low number of automatic bicycle counters, particularly on-road, there is a need to identify novel methods for counting. In collaboration with Dr Xiaojun Chang (Monash University), CI Beck has developed a cutting-edge machine learning computer vision algorithm that can detect and count cyclists using **real-time** video data. This automated approach overcomes the labour-intensive, time-consuming and costly approach of manual bicycle counts.[15] We have developed this algorithm so that it can be applied to closed circuit television (CCTV) camera streams in real-time, rather than relying on the storage of video data, which is time and storage-intensive, and costly. This has been developed in partnership with the Victorian DoT, such that it can be applied to the 330 CCTV cameras that are used to monitor traffic in Melbourne. We will also explore opportunities to access CCTV streams from local councils, such as the City of Melbourne, City of Darebin and City of Port Phillip.

Phoenix (USA) data: PI Nelson has access to Strava data and travel survey data (Maricopa Association of Governments Household Travel Survey), which will be used as dependent variables, and count data (in 44 locations) as the independent variable.

Novelty and Innovation

This project represents a **major step forward** in developing a universal platform that will, for the first time, provide a robust understanding of cycling on each street. Through cutting edge computer vision and machine learning techniques developed by the investigators, this platform will enable us to address critical knowledge gaps in cycling. We will use deep learning methods applied to imagery data to develop a novel inventory of cycling infrastructure; the first time that such a method has been applied to cycling infrastructure globally. Further, we will develop a platform that combines multiple unique datasets and uses advanced statistical modelling and machine learning to develop detailed city-wide models of cycling volumes; the first platform of its kind globally. The use of these methods in fusing big data and automating the development of this model ensures that this approach is scalable and generalisable to other cities, not just in Australia, but globally. The international applicability of the model will be demonstrated through testing and validation in Phoenix, USA.

Understanding cycling volumes at the street-level is fundamentally important to improve safety and progress cycling as a mode of transport. This project will act as a major enabler of future research in both academia and industry. The platform will enable use by transportation agencies, city planners, local governments and cyclists themselves with a

myriad of practical applications, including the development of evidence-informed policy, identifying opportunities to overcome inequity of access, enabling robust evaluations of cycling infrastructure and interventions, prioritising cycling infrastructure investments and increasing cycling participation.

International Collaboration

This project represents substantial international collaboration between the CIs and PIs in Australia, Canada and the USA, including a mix of existing and new collaborations. Specifically, this project will extend existing collaborations between CIs Pettit and Leao and PI Nelson, and CI Beck and PIs Sayed and Winters. Furthermore, CI Beck has a collaborative relationship with Transport for London (TfL) who will provide advice on model development given their experience in the development of TFL's 'Cynemon' model. In addition, we will bring the PI's exceptional skills in transport modelling, machine learning, and cyclist safety to Australia. The project team will engage digitally (email, videoconference) and budget has been requested for an in-depth face-to-face workshop in Australia in Year 1.

INVESTIGATOR(S) / CAPABILITY

The project investigators are at the forefront of transport modelling, cyclist safety and ridership, and machine learning, and are uniquely positioned to deliver this world-leading platform. We bring together internationally renowned researchers in spatial analyses of cycling and transport modelling (CIs Beck, Pettit, Leao and Saberi and PIs Sayed, Nelson and Winters), route choice modelling (CIs Pettit, Leao and Saberi and PIs Nelson and Winters), the development of models of cycling volumes (CIs Pettit and Leao and PIs Sayed, Nelson and Winters) and the utility of computer vision and machine learning techniques (CI Nice and PI Sayed). This team encompasses all of the necessary expertise for the project, have experience in managing international collaborations and have substantial experience in research training, mentoring and supervision (see ROPE). This project will build on existing highly productive collaborations between CIs and PIs[23,29,43,48-49] and will extend the collaborations both within Australia and internationally. Combined, the investigators have unparalleled expertise in transportation modelling and applying these findings to improve cycling safety and to increase cycling participation.

CI Beck will have responsibility for overall project management, oversee data management, ethical approval, participant recruitment, lead the engagement with partner organisations, oversee collaborative involvement of all investigators, and contribute to all project outputs. CI Beck is an internationally-renowned cycling safety expert and has significant expertise in cycling, spatial analyses, modelling and leading large teams. He has extensive national and international collaborations with transportation agencies (Victorian DoT, Transport Accident Commission, Transport for London), cycling advocacy organisations (Bicycle Network, WeRide Australia) and Strava, all of whom have indicated will provide support for this project. He will supervise and develop the research associate and research assistant at Monash University. His 0.4 FTE commitment fits with his projects that continue in 2021 (ARC DECRA Fellowship finishing March 2021), other collaborative projects and leadership roles. He currently supervises 4 PhD students and 1 Masters student.

CI Pettit will share responsibility for Phases 2 and 3 with CI Beck. CI Pettit is internationally recognised for his work on the intersection of geographical information systems and urban planning. He has particular expertise in spatial analyses, city science and urban modelling, and transportation planning. His 0.2 FTE time commitment to this project fits with existing commitments. He has supervised 6 PhDs to completion. CI Pettit will supervise the research associate at UNSW working with CI Leao and CI Saberi on developing and validating the route choice model.

CI Saberi will co-lead the route choice modelling in Phase 2 and contribute to the development of the cycling volume model in Phase 3. CI Saberi is internationally recognised for his extensive experience in transportation modelling, particularly in traffic flow theory and network traffic dynamics. He will commit 0.2 FTE to this project. He has supervised 10 PhD students over the last five years including three PhD completions.

CI Leao will co-lead the route choice modelling in Phase 2 and will contribute to the cycling volume model development in Phase 3. CI Leao has extensive experience in modelling cycling volumes, the use of crowd-sourced cycling data and travel survey data, and route choice modelling. Her 0.2 FTE commitment fits with existing commitments. She has expertise in urban data analytics with a strong focus on big crowdsourced spatial and temporal data, and applications to mobility and active transport in Australia. She currently supervises 3 PhD students.

CI Nice will be responsible for deep learning of imagery data in Phase 1. CI Nice is an early-career researcher with significant experience in computer vision machine learning and urban analytics. His 0.3 FTE commitment in the first year of the project fits with his other 2021 commitments. CI Nice will supervise the research assistant in Phase 1.

PI Sayed is globally renowned for his extensive research in transportation engineering and safety. Given his extensive experience in advanced spatial statistical and machine learning modelling, computer vision machine learning and the development of models of cycling exposure, PI Sayed will provide input into Phase 2 and will oversee the development of the cycling volume model in Phase 3, providing advice to the modelling research

associate and PhD student. He will also provide support for the computer vision machine learning models. He has supervised 83 graduate students.

PI Nelson is an international leader in the field of geographic sciences and spatial analyses, particularly in the application to cities and public health, and active transportation planning. Given her extensive experience in citizen science, the use of crowd-sourced cycling data and the development of models of cycling volumes, PI Nelson will provide research input to the route choice modelling (Phase 2) and the cycling volume model (Phase 3), providing advice to the research associate and research assistant and extending her collaborations with CIs Pettit and Leao. She has supervised 4 post docs, 5 PhD, and 5 Masters students in the past 5 years.

PI Winters is internationally recognised for her substantial contributions to cycling safety and promotion and has extensive experience in citizen science, the use of crowd-sourced cycling data and the development of models of cycling volumes. Therefore, CI Winters will provide research input to Phases 2 and 3, and extend her collaboration with CI Beck. She leads the Cities, Health, and Active Transportation Research Lab and has supervised 1 postdoc, 5 PhD, and 9 Masters students in the past 5 years.

One **research assistant** will be employed at the University of Melbourne in Year 1 with experience in deep learning and/or the use of imagery data (Phase 1). One **research associate** will be employed at Monash University for 3 years to lead the collection of GPS route data, prepare spatial data and lead the development of the statistical model in Phase 3. They will be supported by a **research assistant** in Years 1 and 2. One **research associate** will be employed at UNSW to develop and implemented the route choice model in Year 2. One **PhD candidate** (Monash University) will investigate the utility of machine learning models for modelling bicycle volumes (Phase 3). The candidate will be supervised by CIs Beck and Saberi, PI Sayed and our collaborator Prof Le Hai Vu (Monash).

BENEFIT

This project will develop a world-leading platform to model city-wide cycling volumes. This will be a substantial step change in our understanding of cycling and is **the platform** that is needed to propel cycling forward both in Australia and internationally. The absence of fine-scale cycling volumes hinders the progression of cycling safety and the implementation of cycling infrastructure. This priority has been highlighted in the *State Government of Victoria's Cycling Strategy 2018-2028.* Furthermore, the need for better data on cycling volumes and the potential of these data to inform infrastructure planning and implementation has also been strongly emphasised in the *Victorian Department of Transport's 'Walking and Cycling Data Framework and Action Plan'* (of which CI Beck was an invited expert).

For the first time, the platform developed in this project will provide a robust understanding of cycling volumes on each street that will enable us to address significant knowledge gaps in our understanding of cycling safety, the effectiveness of cycling infrastructure and the identification of areas in need of enhanced cycling infrastructure. Specifically, we will use this platform in subsequent projects to map cyclist crashes (using data from both the Victorian State Trauma Registry (CI Beck) and the Victorian DoT's CrashStats database) to identify locations ('hot spots') where there is increased crash risk, accounting for cycling volume, to evaluate the effectiveness of existing cycling infrastructure, and to enable the identification of 'safe' routes and enable route planning by cyclists. Further, this platform will enable us to identify opportunities to improve the cycling network and adapt to a rapidly changing world (such as share bikes, e-bikes and food delivery bikes). Deloitte have predicted that 130 million e-bikes will be sold between 2020 and 2023, resulting in a more than doubling in the number of regular bicycle users in major cities. This project will ensure that we can rapidly adapt to these needs. Understanding city-wide cycling volumes will also provide us with new insights into inequities in cycling. By understanding cycling infrastructure and participation at the neighbourhood-level, we can identify areas with inadequate cycling infrastructure and access to services, such as public transport, and identify areas of low cycling participation. These insights will enable us to enhance cycling in areas of low participation, to ensure equitable distribution of cycling infrastructure and to provide those in low socioeconomic areas with greater opportunities to cycle. Overall, we anticipate that the application of these data will result in improved safety for cyclists, lower injury rates, increased cycling participation, and reduced inequities, thereby resulting in substantial gains in population and environmental health.

There are numerous links between this project and key Government strategies and priority areas. The project directly addresses the *Australian Government's National Science and Research Priorities* of Transport (specifically priority areas of "improved modelling", "spatial analysis", "sustainable mobility", and "lowering carbon emissions") and Health (through improving cyclist safety and thereby enhancing cycling participation and physical activity). It also addresses the *Australian Government's Infrastructure Plan* priorities of "shifting people from cars to public transport and active transport", and "new ways of generating, collecting, sharing and analysing data….to determine where investment is most required". This is in addition to the *Victorian Cycling Strategy 2018-2028* and *Victorian Department of Transport's 'Walking and Cycling Data Framework and Action Plan* mentioned above.

We anticipate that this project will become the benchmark and ongoing mechanism for monitoring cycling in Australia and internationally into the future. We will develop a platform that can generate inventories of cycling infrastructure and model cycling exposure across the globe. The applications to cycling safety and cycling promotion are extensive and we envisage that the outcomes will have profound health, environmental and societal benefits.

FEASIBILITY

The project is highly feasible in the three-year time frame. Combined, the investigators have significant expertise in the proposed methods, strong track records in delivering major projects on time and budget, and the stakeholder relationships to successfully execute the project. CI Nice and PI Sayed have significant expertise in computer vision machine learning (Phases 1 and 3); CI Beck has significant experience in recruiting cyclists for data collection (Phase 2); CIs Pettit, Leao and Saberi and PI Nelson have significant expertise in route choice modelling; and CIs Pettit and Leao and PIs Sayed, Nelson and Winters all have significant expertise in modelling cycling volumes (Phase 3). In-kind support from partner organisation Bicycle Network will ensure that we are able to collect the required GPS data in Phase 2. In-kind support from Strava to provide bicycle volume data at no cost demonstrates the global importance of this project. Preliminary and related work already completed by our team (e.g. deep learning of imagery data, computer vision model to count cyclists, experience in working with Strava data), approval to access existing data, and partnerships developed with the Victorian DoT, Bicycle Network and Strava, will further ensure the feasibility of a timely completion of this project. A project timeline is shown below.

	2021				2022				2023			
	1	2	3	4	1	2	3	4	1	2	3	4
Phase 1: Deep learning of imagery data												
Model development												
Development of infrastructure database												
Phase 2: Route choice modelling												
App development												
Collection of GPS route data												
GPS data cleaning / preparation												
Preparation of spatial data												
Preparation of VISTA data												
Route choice model												
Estimating volumes from travel survey data												
Phase 3: Cycling volume model development												
CCTV count data collection												
Preparation of spatial data												
Preparation of Strava data												
Statistical model development												
Machine learning model development												

The research is cost-effective, through our use of existing data and efficient methods of capturing additional data. We will use open-source data and data provided in-kind by transport authorities, CI's academic institutions and through research data infrastructure platforms, such as AURIN. Moreover, by making the data generated from this project available to end users, we will make future research more cost-effective. This will be achieved through the use of UNSW City Futures Research Centre's CityViz urban data visualisation and analytics platform, and the Victorian DoT's new data platform (led by the Safe System Road Infrastructure Program). Given that CI Beck has estimated that the total cost of health loss associated with one severely injured cyclist is almost $1 million,[50] and that physical inactivity is estimated to cost the Australian economy nearly $1 billion each year,[51] the outcomes of this project and subsequent research have the potential to result in significant economic gain through reductions in injury rates and improvements in physical activity and population health. Therefore, this project is extremely cost-effective.

This project will be a collaborative program across three Australian universities. Monash University (CI Beck), the University of New South Wales (CIs Pettit, Leao and Saberi) and the University of Melbourne (CI Nice) are outstanding research environments as demonstrated by their exceptional international reputation and being ranked in the top 100 universities globally. Specifically, this will be a partnership between Monash University's School of Public Health and Preventive Medicine (SPHPM) and the Monash Centre for Data Science, the University of Melbourne's Transport, Health and Urban Design (THUD) Research Hub, and UNSW's City Futures Research Centre and the Research Centre for Integrated Transport Innovation (rCITI). Combined, these centres comprise international expertise in big data, data science and AI, statistics, modelling, spatial analyses, transport, health and urban design. Furthermore, these centres provide world-leading research governance, infrastructure, support and

mentoring. This project strongly aligns with Monash University's priorities of undertaking research of the highest international quality that tackles major research challenges, building strong international partnerships, fostering a culture of innovation, building deep partnerships to support the translation of research and Monash University's key focus areas of 'Sustainable Development' and 'AI and Data Science'. Additionally, this project strongly aligns with the UN Sustainable Development Goals of Good Health and Well-being (Goal #3) and Sustainable Cities and Communities (Goal #11).

The three collaborating centres all have the facilities required for the machine learning, imagery data, spatial data, statistical modelling and data visualisations, along with high-level technical and intellectual support. All centres have made significant investments in research infrastructure with world-class data and technology platforms. Monash University offers world-leading computational facilities. For Phase 2 and 3, we will leverage Monash's High Performance Computing (HPC) facilities including the Multi-modal Australian ScienceS Imaging and Visualisation Environment (MASSIVE). Monash has recently committed $4.1 million to upgrade this advanced technology cluster designed specifically to process complex data. We will also leverage Monash University's Nearmap license to access satellite imagery data and utilise UNSW City Futures Research Centre's CityViz urban data visualisation and analytics platform for dissemination.

Through this project and through CI Beck's strong collaborative relationships, we will establish an advisory group that will comprise members of transportation agencies (the Victorian DoT and the Transport Accident Commission), city planners, local government, bicycle advocacy organisations (Bicycle Network, WeRide Australia), other researchers and policy makers. The advisory group will ensure that the outcomes of this project are relevant, timely and will be used to enact improvements in cycling. Furthermore, this project will provide excellent research training and career development for early and mid-career CIs, and the two research fellows and one PhD student who are essential to the project's success. It will also grow the workforce in this critical area of need.

COMMUNICATION OF RESULTS

Findings will be shared with the research community via academic publications in the highest-ranking journals in the transport and AI fields, prioritising open access for maximum impact. Where articles are not open access, they will be placed in the Monash University open access repository. The research team are regularly asked to present at leading international and national conferences and workshops and will use these opportunities to disseminate project findings. Data will be disseminated through university data and analytics platforms and with the Victorian DoT. The framework for this platform will be made open access to maximise its utility and impact. A project advisory group will be setup that will enable regular engagement with partner organisations to ensure the project outcomes are relevant for policy makers and end users and lead to the greatest impact. Findings will also be presented to the newly formed Federal Office of Road Safety with a plan to scale the project to a national level.

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Part E - Project Cost (DP210102089)

E1. What is the proposed budget for the project?

(There are rules around what funds can be requested from the ARC. You must adhere to the scheme specific requirements listed in the grant guidelines. Refer to the Instructions to Applicants for detailed instructions on how to fill out the budget section.)

Total requested budget: $549,106

Year 1

Description	ARC	Admin Org		Other Eligible Org		Other Org	
	Cash	Cash	In-kind	Cash	In-kind	Cash	In-kind
Total	239,460	35,584	61,984		178,996		80,575
Personnel	172,647	35,584	61,984		178,996		70,675
CI Beck (Level C Step 4 @ 0.4 FTE)			61,984				
Research Fellow (Monash University; Level A Step 3 @ 0.8 FTE in Years 1&2 and 0.6 FTE in Year 3)	96,324	5,683					
Research Assistant (Monash University; HEW 3 Step 7 @ 0.4 FTE)	30,529	901					
CI Pettit (UNSW; Level E @ 0.2 FTE)					55,512		
CI Saberi (UNSW; Level C @ 0.2 FTE)					40,191		
CI Leao (UNSW; Level C @ 0.2 FTE)					36,181		
CI Nice (University of Melbourne; Level B @ 0.3 FTE)					47,112		
Research Assistant (University of Melbourne; HEW 3 Step 7 @ 0.6 FTE)	45,794						
PI Sayed (Professor @ 0.1 FTE)							28,270
PI Nelson (Professor @ 0.1 FTE)							30,263
PI Winters (Associate Professor @ 0.1 FTE)							12,142
PhD Stipend (Monash University)		29,000					
Travel	15,744						
Travel and accommodation for CIs/PIs to attend an intesive workshop in Melbourne in Year 1	15,744						
Equipment	11,069						
IT infrastructure to be implementing in the Victorian Department of Transport Intelligent Transport Systems division	11,069						
Other	40,000						9,900
App development	40,000						
Promotion of GPS app use by Bicycle Network							9,900

Year 2

Description	ARC	Admin Org	Other Eligible Org	Other Org

	Cash	Cash	In-kind	Cash	In-kind	Cash	In-kind
Total	232,097	36,014	80,499		131,884		70,675
Personnel	220,496	36,014	80,499		131,884		70,675
CI Beck (Level C Step 4 @ 0.4 FTE)			80,499				
Research Fellow (Monash University; Level A Step 3 @ 0.8 FTE in Years 1&2 and 0.6 FTE in Year 3)	99,867	6,068					
Research Assistant (Monash University; HEW 3 Step 7 @ 0.4 FTE)	31,138	946					
CI Pettit (UNSW; Level E @ 0.2 FTE)					55,512		
CI Saberi (UNSW; Level C @ 0.2 FTE)					40,191		
CI Leao (UNSW; Level C @ 0.2 FTE)					36,181		
Research Fellow (UNSW; Level A Step 6 @ 0.7 FTE)	89,491						
PI Sayed (Professor @ 0.1 FTE)							28,270
PI Nelson (Professor @ 0.1 FTE)							30,263
PI Winters (Associate Professor @ 0.1 FTE)							12,142
PhD Stipend (Monash University)		29,000					
Equipment	11,069						
IT infrastructure to be implementing in the Victorian Department of Transport Intelligent Transport Systems division	11,069						
Other	532						
Bureau of Meteorology data	532						

Year 3

Description	ARC	Admin Org		Other Eligible Org		Other Org	
	Cash	Cash	In-kind	Cash	In-kind	Cash	In-kind
Total	77,549	32,640	85,235		131,884		70,675
Personnel	77,549	32,640	85,235		131,884		70,675
CI Beck (Level C Step 4 @ 0.4 FTE)			85,235				
Research Fellow (Monash University; Level A Step 3 @ 0.8 FTE in Years 1&2 and 0.6 FTE in Year 3)	77,549	3,640					
CI Pettit (UNSW; Level E @ 0.2 FTE)					55,512		
CI Saberi (UNSW; Level C @ 0.2 FTE)					40,191		
CI Leao (UNSW; Level C @ 0.2 FTE)					36,181		
PI Sayed (Professor @ 0.1 FTE)							28,270
PI Nelson (Professor @ 0.1 FTE)							30,263
PI Winters (Associate Professor @ 0.1 FTE)							12,142
PhD Stipend (Monash University)		29,000					

Other Eligible Organisation

Organisation	Year 1		Year 2		Year 3	
	Cash	In-kind	Cash	In-kind	Cash	In-kind
The University of New South Wales		131,884		131,884		131,884
The University of Melbourne		47,112				
Total		178,996		131,884		131,884
Committed Total		178,996		131,884		131,884

Other Organisation

Organisation	Year 1		Year 2		Year 3	
	Cash	In-kind	Cash	In-kind	Cash	In-kind
The University of British Columbia		28,270		28,270		28,270
Arizona State University		30,263		30,263		30,263
Simon Fraser University, Canada		12,142		12,142		12,142
BICYCLE NETWORK INCORPORATED		9,900				
Total		80,575		70,675		70,675
Committed Total		80,575		70,675		70,675

E2. Justification of funding requested from the ARC

(Fully justify, in terms of need and cost, each budget item requested from the ARC. Use the same headings as in the Description column in the above Budget Table of this application. (Upload a PDF of up to four A4 pages and within the required format))
Budget Justification

Uploaded PDF file follows on next page.

E2—Justification Funding Requested from the ARC

Personnel

Monash University Research Fellow *(Level A, Step 3; 0.8 FTE in Years 1&2 and 0.6 FTE in Year 3):* Successful completion of this project will require strong project management from a post-doctoral research fellow with expertise in spatial data and spatial statistics. The Research Fellow will be supervised by CI Beck at Monash University and will manage ethics applications, coordinate the preparation of spatial and travel survey data, and coordinate the collection of the GPS route data. They will take responsibility for all data in Phase 2 and Phase 3 and will be responsible for the development of the spatial statistical model in Phase 3. They will work closely with and be strongly supported by all CIs and PIs. They will also be supported by a Research Assistant (detailed below) who will support the preparation and cleaning of spatial data and GPS data.

Level A, Step 3 is the minimum requirement for a candidate with a PhD at Monash University. Salary including 30% on-costs has been calculated using Monash University academic salary scales. The position is for 0.8 FTE for Years 1 and 2 to reflect the significant data demands in the first two years of the project, and 0.6 FTE for Year 3 in which the Research Fellow will lead the development of the spatial statistical model.

Monash University Research Assistant *(HEW 3, Step 7; 0.4 FTE in Years 1&2):* Given the depth of spatial data required for this project, one Research Assistant is required to clean and prepare GPS route data and spatial data. This will include road infrastructure and traffic volume data, land use data, travel survey data, Strava data, weather data, Census data and bicycle count data. They will work closely with the Monash University Research Fellow and CI Beck. Salary including 30% on-costs has been calculated using Monash University salary scales. The position is for 0.4 FTE in Years 1 and 2 to reflect the significant data demands in the first two years of the project.

University of Melbourne Research Assistant *(HEW 3, Step 7; 0.6 FTE in Year 1):* One Research Assistant with experience in deep learning and/or the use of imagery data will be employed to work with CI Nice on Phase 1 at the University of Melbourne. The preparation of large volumes of satellite imagery data and other imagery data requires a significant time commitment. The Research Assistant will prepare all data and work with CI Nice to implement the computer vision deep learning algorithm. Salary including 30% on-costs has been calculated using University of Melbourne salary scales. The position is for 0.6 FTE in Year 1 to reflect the needs in Phase 1 of the project. As Phase 1 is required to inform Phases 2 and 3, it is critically important that CI Nice is supported in his leadership of Phase 1.

UNSW Research Fellow *(Level A, Step 6; 0.7 FTE in Year 2):* One Research Fellow with experience in route choice modelling is required to develop and implement the model in Phase 2. They will work closely with CIs Pettit, Leao and Saberi at UNSW. The specific skill set required for this modelling dictates that it cannot be completed by the Monash University Research Fellow and is beyond the time-capabilities of the Monash University Research Fellow. As such, the position is for 0.7 FTE in Year 2 to reflect the needs of Phase 2. Having the position commence in Year 2 will also enable the appropriate candidate to be identified in Year 1. Salary including 30% on-costs has been calculated using UNSW salary scales.

Travel

CI/PI Workshop in Melbourne, Australia: A 3-day face-to-face workshop will be conducted in Year 1 where all CIs and PIs will travel to Melbourne, Australia. This is critical for detailed project planning, in-depth methodological discussions and for CIs and PIs to meet project staff. During this time, a Project Advisory Group meeting will be held that will enabled CIs and PIs to meet government (Victorian Department of Transport, Transport Accident Commission, local government agencies) and bicycle advocacy (Bicycle Network, WeRide Australia) partners. In addition to this face-to-face meeting, the Project Advisory Group will meet quarterly via videoconference.

Budget is requested for travel for CIs Pettit, Leao and Saberi (from Sydney: flight cost estimate from Qantas $400 economy return per person), PI Sayed (from Vancouver, Canada: flight cost estimate for Qantas $2,500), PI Nelson (from Arizona, USA: flight cost estimate for Qantas $2,500) and PI Winters (from Vancouver, Canada: flight cost estimate for Qantas $2,500). As recommended by the Australian Taxation Office (ATO), a per diem (including accommodation, meals and incidentals) of $391.30 per day will be applied for three interstate CIs and three international PIs for the 3-day intensive workshop (totalling $7,043.40). The total budget for this workshop is $15,743.

Equipment

Victorian Department of Transport IT infrastructure: As part of the collection of bicycle count data using CCTV data for Phase 3, we are required to implement IT infrastructure within the Intelligent Transport Systems unit of the Victorian Department of Transport (DoT). This equipment requires extensive graphical processing to be able to handle large amounts of video data in real-time. This is beyond the capabilities of current DoT infrastructure and in excess of what could be implemented as part of DoT routine business. Therefore, budget is requested to hire appropriate IT infrastructure through DoT's IT provider (for security reasons, these are the only providers of IT equipment to DoT and equipment must be hired and not purchased). DoT have provided per month costings for the video analytic server ($1,174.16/Month) and video router server ($670.59/Month). This will result in a $1,844.75/month cost and a $22,137 cost over a 12-month period of data collection. This cost will be shared between years 1 and 2.

Other

App development: In Phase 2, we require the capture of detailed GPS route data from cyclists. Previous mobile phone applications that had this capability (such as Bicycle Network's 'Riderlog' app) are no longer supported. Therefore, in partnership with Bicycle Network, we will leverage our collaborator's, Prof Mark Stevenson's, iOS and Android application that accesses GPS coordinates and maps individual motor vehicle trips and develop the app in a format specific for cyclists. This has been costed at $40,000.

Bureau of Meteorology data: We require 12 months of historical temperature and rainfall data to inform Phase 3 modelling. The Bureau of Meteorology provide gridded spatial datasets of historical data for $266 per data item (total $532).

E3. Details of non-ARC contributions

(Provide an explanation of how non-ARC contributions will support the proposed application. Use the same headings as in the Description column in the above Budget Table of this application. (Upload a PDF of up to two A4 pages and within the required format))
Details of Non-ARC Contributions

Uploaded PDF file follows on next page.

E3—Details of Partner org and non-ARC contributions

Personnel

CI Beck (Level C Step 4 @ 0.4 FTE)

CI Beck will commit 40% of his time to this project. Monash University will fund the salary contribution of CI Beck including on-costs for the three years of the project. As CI Beck's ARC DECRA Fellowship ends on March 8 2021, a fractional weighting of 80.6% has been applied to the calculated contribution from Monash University in Year 1.

CI Beck leads the Active Transport, Health and Injury Stream in the School of Public Health and Preventive Medicine at Monash University. CI Beck is internationally renowned for his work in cycling safety and has significant expertise in cycling, spatial analyses, modelling and leading large teams. He will have overall responsibility for the success of the project, including overall project management, overseeing data management, ethical approval, participant recruitment, the collaborative involvement of all investigators and relationships with partner organisations. CI Beck will work closely with the Monash University Research Fellow, Research Assistant and PhD student.

CI Pettit (UNSW; Level E @ 0.2 FTE)

CI Pettit will commit 20% of his time to this project. UNSW will fund the salary contribution of CI Pettit including on-costs for the three years of the project.

CI Pettit is the inaugural Chair of Urban Science at UNSW and the Director of the City Analytics Program and Associate Director City Futures Research Centre. CI Pettit is internationally recognised for his work on the intersection of geographical information systems and urban planning. He has particular expertise in spatial analyses, city science and urban modelling, and active transportation planning. CI Pettit will share lead responsibility for Phases 2 and 3 with CI Beck, will co-supervise the UNSW Research Fellow and work closely with CIs Beck, Leao and Saberi.

CI Saberi (UNSW; Level C @ 0.2 FTE)

CI Saberi will commit 20% of his time to this project. UNSW will fund the salary contribution of CI Saberi including on-costs for the three years of the project.

CI Saberi is a Senior Lecturer in the Research Centre for Integrated Transport Innovation (rCiti). CI Saberi has extensive experience in transportation modelling, particularly in traffic flow theory and network traffic dynamics. CI Saberi will co-supervise the UNSW Research Fellow, contribute to the route choice modelling in Phase 2 and the cycling volume model in Phase 3.

CI Leao (UNSW; Level C @ 0.2 FTE)

CI Leao will commit 20% of her time to this project. UNSW will fund the salary contribution of CI Leao including on-costs for the three years of the project.

CI Leao is a Senior Lecturer in the City Futures Research Centre and the Associate Dean (International) of the Faculty of Built Environment at UNSW. CI Leao has extensive experience in the development of models of cycling volumes, the use of crowd-sourced cycling data and travel survey data, and route choice modelling. CI Leao will be responsible for the development of the route choice model in Phase 2 in partnership with CIs Pettit and Saberi and the UNSW Research Fellow.

CI Nice (University of Melbourne; Level B @ 0.3 FTE)

CI Nice will commit 30% of his time to the first year of the project. The University of Melbourne will fund the salary contribution of CI Nice including on-costs for the first year of the project.

CI Nice is a Research Fellow in the Transport, Health and Urban Design (THUD) Research Hub at the University of Melbourne. He is an early-career researcher with significant experience in computer vision machine learning and urban analytics. Given his track record in the use of these methods to imagery data, CI Nice will lead the development of Phase 1 and supervise the University of Melbourne Research Assistant.

PI Sayed (Professor @ 0.1 FTE)

PI Sayed will commit 10% of his time to this project. The University of British Columbia will fund the salary contribution of PI Sayed including on-costs for the three years of the project.

PI Sayed is a Distinguished Professor at the University of British Columbia, Canada, and Tier 1 Canada Research Chair of Transportation Safety and Advanced Mobility. PI Sayed is globally renowned for his extensive research in transportation engineering and safety. Given his extensive experience in advanced spatial statistical and machine

learning modelling, computer vision machine learning and the development of models of cycling exposure, PI Sayed will provide input into Phases 2 and 3 of the project.

PI Nelson (Professor @ 0.1 FTE)

PI Nelson will commit 10% of her time to this project. Arizona State University will fund the salary contribution of PI Nelson including on-costs for the three years of the project.

PI Nelson is the Director of the School of Geographic Sciences and Urban Planning at Arizona State University, USA. PI Nelson is an international leader in the field of geographic sciences and spatial analyses, particularly in the application to cities and public health, and active transportation planning. Given her extensive experience in citizen science, the use of crowd-sourced cycling data and the development of models of cycling volumes, PI Nelson will provide research input to Phases 2 and 3.

PI Winters (Associate Professor @ 0.1 FTE)

PI Winters will commit 10% of her time to this project. Simon Fraser University will fund the salary contribution of PI Winters including on-costs for the three years of the project.

PI Winters is Director of the Cities, Health and Active Transportation Research Lab (CHATR) and an Associate Professor at Simon Fraser University, Canada. PI Winters is internationally recognised for her substantial contributions to cycling safety and promotion and has extensive experience in citizen science, the use of crowd-sourced cycling data and the development of models of cycling volumes. Therefore, CI Winters will provide research input to Phases 2 and 3.

Monash University PhD Stipend

The School of Public Health and Preventive Medicine, Monash University, will provide funds for a PhD student to be trained within the context of this project. Specifically, the student will focus on the development of the machine learning model in Phase 3. Given that model development is planned in Year 3, this will give the student sufficient time to be able to develop relevant skills and methodologies that will form the initial studies of the PhD thesis. They will then apply these approaches to Phase 3 data. Given the novelty of these models as applied to bicycle volumes, it is anticipated that the work will be of high-impact. The student will be closely supervised by CI Beck (Monash University), CI Saberi (UNSW), PI Sayed (University of British Columbia, Canada) and our Monash University collaborator Professor Le Hai Vu. Professor Vu leads Intelligent Transport Systems (ITS) research at Monash University and is an internationally recognised expert in the application of machine learning/deep learning in transport modelling.

The School of Public Health and Preventive Medicine will offer an annual stipend of $29,000 (2020$), which is the standard Monash University rate for PhD stipends. Funding will be provided for the duration of the project (3 years).

Other

Bicycle Network

Bicycle Network will provide $9,900 of in-kind contributions to promote the uptake and utilisation of the GPS application that will capture route data from cyclists (Phase 2). Specifically, they will provide $1,400 in purchase giveaways and incentives, $1,500 in vouchers to Bicycle Network events, and will pursue existing partners to provide giveaways and discounts (48 hours of staff time budgeted at $2,400). From a marketing perspective, Bicycle Network will conduct dedicated campaign management to promote the use of the GPS application (38 hours of staff time budgeted at $1,900) via existing mailing lists (200,000 – 300,000 individuals) and existing members (45,000+ members). Bicycle Network will also dedicate employee hours to organise and attend: activations at riding events (24 hours of staff time budgeted at $1,200) and intercepts at known cycling routes (30 hours of staff time budgeted at $1,500) to promote the GPS application and associated interventions for ongoing use.

Part F - Participant Details including ROPE (Dr Ben Beck)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Chief Investigator

Title

Dr

First Name

Ben

Second Name

Family Name

Beck

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
17/12/2012	Doctoral Degree	Doctor of Philosophy	Faculty of Medicine	University of New South Wales	Australia
12/12/2008	Bachelor Degree	Bachelor of Engineering (Biomedical) (Hons)	Biomedical Engineering	University of Melbourne	Australia

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

Uploaded PDF file follows on next page.

F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area**	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
Boufous S, Ivers R, Macniven R, Pettit C, **Beck B.** 'Cycling, Mobility and Safety in Older People'. *UNSW Ageing Futures Institute Seed Research Grant.* 2020.	Y	C		50						
Stratton G, Fry G, Griffiths L, Brophy S, Watkins A, Lyons R, Christian H, Boruff B, Trost S, Cross D, Rosenberg M, Murray K, **Beck B**, Schipperijn J, Gething P, Mizen A. 'Built Environments And Child Health in WalEs and AuStralia (BEACHES)'; 2020-2022.	N	R	APP1192764	515	515	515				

Beck B. 'Benchmarking Road Safety Outcome indicators between State of Victoria, Australia and British Columbia, Canada'. *BC Centre for Disease Control, British Columbia, Canada.* 2019-2020	N	C		4						
Gabbe B.J, Cameron P.A, **Beck B.** 'The operation and utilisation of the Victorian State Trauma Registry'; *Department of Health, Victoria;* 2019-2021.	N	C		1,016	1,035					
Hunter K, Brown J, Bennet-Brook K, Bestman A, Mills R, Kay M, van der Meulen M, Hunnisett C, Fang J, Keay L, Clapham K, Elkington J, **Beck B**. 'National Injury Prevention Strategy – Facilitator / Writer'; *Australian Government Department of Health*, 2019-2020.	N	C		208						

Scott D (Co-CIA), **Beck B (Co—CIA)**, Ogeil R, Kumar D, Smith K, Gabbe B, Lubman D. 'Linking Victorian State Trauma Registry and Ambo Data to Explore the relationships between trauma, alcohol and drug use, self-harm and mental health'; *Monash Addiction Research Centre (MARC) Collaborative Seed Funding Project Grant*; 2019-2020	N	C		34						

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.4

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
Monash University	Yes	Employee	1.0

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

Monash University

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

Identifier	Investigators	Admin Organisation	Project Title	Funding	End Date	Final Report Due Date	Final Report Status
DE180100825	Dr Ben Beck	Monash University	Evaluating interventions to prevent serious road traffic crashes	$336,128	08/03/2021	08/03/2022	Draft

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

Yes

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this

application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should this application be successful the participant will exceed ARC project limits and must meet the project limits under the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

No PDF file uploaded.

F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Senior Research Fellow	School of Public Health and Preventive Medicine	Contract	Full Time	01/01/2019		Monash University
Research Fellow	School of Public Health and Preventive Medicine	Contract	Full Time	09/02/2015	31/12/2018	Monash University
Defence Scientist	Human Protection and Performance Division	Permanent	Full Time	09/02/2012	08/02/2015	Defence Science and Technology Group

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

Yes

From when

01/03/2012

To when

28/02/2015

FTE of academic interruption

1.0

Interruption Category

Non-research career

Details

From March 2012 until February 2015, I was employed by the Defence Science and Technology Organisation (DSTO) in a non-academic role. In this role, I led a team of biomechanists and a program of work that focussed on injury prevention. During this time, the majority of my work was of a classified nature. As a result, the outcomes could only be communicated in classified internal reports. This precluded publishing in the open literature and therefore has impacted on my record of publications.

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

Uploaded PDF file follows on next page.

F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

I graduated 7.5 years ago with a PhD in injury in 2012 and I have experienced 2.5 years of academic interruption during this period.

From 2012 to 2015, I was employed by the Australian Defence Science and Technology Organisation (DSTO) in a non-academic role. I returned to academia in March 2015 and have been employed in a full-time research-only role since this time.

Research Opportunities

I am a Senior Research Fellow in the School of Public Health and Preventive Medicine (SPHPM) at Monash University. I am Deputy Head (currently acting-head for 3 months) of the Prehospital, Emergency and Trauma (PET) Research Group and lead the Active Transport, Health and Injury Stream within SPHPM.

I returned to academia in 2015 as a Research Fellow (Level B) in SPHPM. During this time, I have been promoted to Deputy Head of our research group (2018) and promoted to Level C (2019). My current role is 80% research and 20% engagement / leadership / administration. I also hold an adjunct Associate Professor position at Laval University, Quebec City, Quebec, Canada. I am the current holder of an ARC DECRA Fellowship (DE180100825) that links injury data (from the Victorian State Trauma Registry, of which I am a CI) with road safety data (from the Victorian Department of Transport, Victoria Police, Transport Accident Commission and Ambulance Victoria). Using advance spatial statistical models, the objective of this project is to evaluate the effectiveness of geographically-specific road safety interventions. Through this DECRA Fellowship, I have strengthened my collaborative relationships with transport and road safety authorities, set up data repositories and frameworks to a world-leading standard, and established cross-faculty and cross-university teams that combine world-leading academics in health and injury data, engineering, road safety, spatial analytics and statistics. As an engineer working in a School of Public Health, I pride myself on my ability to bring together world-leading academics across a breadth of fields and disciplines to solve local and global health problems.

I have received exceptional mentoring over my academic career. This includes A/Prof Julie Brown (PhD supervisor; Head of the Injury Division, The George Institute for Global Health), Prof Belinda Gabbe (Head of PET Group, Monash University), Prof Rebecca Ivers (Head of School of Public Health, UNSW) and Prof Sally Green (Deputy Head, School of Public Health, Monash University). Given my impressive performance over the last 5 years, I have strong support from senior leadership in SPHPM that has resulted in my appointments as Deputy Head of PET Research, and as lead of the Active Transport, Health and Injury Stream. Further, SPHPM will financially support my position beyond my current DECRA Fellowship.

Research Achievements and Contributions

I am internationally renowned for my work in cycling safety, as exemplified by numerous international and national keynote presentations, awards, media and strong translational outcomes. I lead a large body of trauma and injury prevention research, with a focus on the intersection between transport and health. Through my strong collaborative relationships with government, industry, practitioners, clinicians and the active dissemination of my research in the media, my research has informed injury prevention activities, changed policy and practice and will continue to reduce the burden of injury globally.

Research outputs and income

Since returning to academia 5 years ago, I have demonstrated an impressive trajectory, having published 50 papers, 14 government reports, secured over $4 million in research funding and have continued to demonstrate strong translational outcomes. This level of output is commensurate with an academic at a Professorial level. I have been awarded 14 grants in the last 5 years, with diversified funding sources, including the Australian Research Council, the Victorian Department of Health, the Transport Accident Commission, the Royal Automotive Club of Victoria and the BC Centre for Disease Control, Canada. Throughout my career, I have pursued an applied research agenda related to injury prevention and cyclist safety, that values the integration and knowledge provided by government partners (such as the TAC and Department of Transport) and cyclist advocacy organisations (such as the Amy Gillett

Foundation, Bicycle Network and WeRide Australia). I am regularly consulted by all of these organisations to provide expert commentary on policy and advocacy.

Prizes, honours and awards
My research excellence and global standing, particularly in cycling safety, is recognised through numerous high-profile national and international awards. These include:

- 2019 International Cycling Safety Conference Award for Best Presentation,
- 2019 Australasian College of Road Safety Peter Vulcan Award for Best Research Paper at the 2019 Australasian Road Safety Conference,
- 2018 Monash University Faculty of Medicine, Nursing and Health Sciences Exceptional Achievement Award,
- 2017 European Resuscitation Council Congress Young Investigator – Ian Jacobs Award,
- 2017 Royal Australasian College of Surgeons Brendan Dooley/Gordon Trinca Trauma Research Scholarship,
- 2017 Australian Resuscitation Council Spark of Life Conference Best Paper Award
- 2017 Australasian Trauma Society Conference – Best non-medical poster award,
- 2016 Monash University School of Public Health and Preventive Medicine Early Career Researcher Award for Excellence, and
- 2015 European Resuscitation Council Congress – 'Best of the Best' – Runner-up, Prague, Czech Republic.

Invited keynote and speaker addresses
I am regularly invited to provide presentations at international and national conferences, which has included three keynote presentations and 16 invited presentations. These have included keynote presentations at the International Road Safety Symposium in Vancouver, Canada, and the Australian Walking and Cycling Conference, and invited presentations to the Australian Government Federal Office of Road Safety, the International Cycling Safety Conference Expert Workshop and the WeRide Australia Bicycle Summit. I am also regularly invited to provide presentations to local cycling clubs and groups.

Given the social and economic significance of my research, I am regularly invited to comment in the media, particularly on injury prevention and cycling safety topics. This has included over 50 interviews across TV (e.g. ABC TV, SBS, Channel 9), radio (e.g. ABC Radio, 3AW, 2GB), and print and online media (e.g. The Guardian, The Age, The Herald Sun, Daily Telegraph, Forbes.com, Streetsblog USA, Road.cc, CyclingTips).

Other professional activities and leadership
As President of the Australasian Injury Prevention Network (AIPN), the peak body for injury prevention in Australia and New Zealand, I lead an organisation of over 150 injury prevention experts. Through my leadership, the AIPN have made numerous highly influential government submissions that have led to changes in policy and practice. Furthermore, I am currently leading the development of the Australian National Injury Prevention Strategy 2020-2030 with the Australian Government Department of Health and the George Institute for Global Health. This has involved engaging with over 100 government, not-for-profit and academic institutions/individuals to develop the Strategy.

In my current roles as Lead of the Active Transport, Health and Injury Stream and Deputy Head of Prehospital, Emergency and Trauma (PET) Research at Monash University, I have fostered strong collaborative relationships with industry and government, established cross-faculty and international collaborations, and have increased our research exposure through media and social media. I have also fostered a supportive and motivating environment in the group, through providing mentoring to staff and setting up regular group activities.

As part of the International Collaborative Effort Injury Statistics and Methods (Injury-ICE), I have established and was appointed co-lead of the sub-committee on geospatial analyses for injury research. This sub-committee brings together global leaders in spatial analyses to progress the application of these methods to injury prevention (particularly cycling and walking data), establish international collaborations and to set future research agendas.

Other professional activities include my roles on the Organising Committee for the World Injury Conference (Safety 2020) in partnership with the World Health Organisation, the Australasian College of Road Safety (Victorian Chapter), the Scientific Committee for the Australasian Road Safety Conference, the Organising Committee for the Australasian Injury Prevention and Safety Promotion Conference, the Childhood Injury Prevention Alliance

(CHIPA), the Monash Alfred Injury Network (MAIN), and the Victorian State Trauma Outcomes Registry Monitoring (VSTORM) Group. I am also a reviewer for leading transport and health journals, including Accident Analysis and Prevention, Transport Reviews, the Medical Journal of Australia, Nature Scientific Reports, Injury, Injury Prevention and the Journal of Transport and Health. I have also been appointed by the Federal Health Minister to review the National Preventive Health Strategy and by the National Health and Medical Research Council to review policy documents on injury prevention and road safety.

I currently supervise 5 HDR students (4 PhD, 1 masters) across the fields of cycling promotion, injury prevention and spatial modelling. In addition to my mentoring roles in the PET Group, I currently mentor 4 students and early-career researchers.

Research impact and advancement of knowledge

Over my career, I have consistently demonstrated strong translational outcomes. These contributions to road safety and injury include:

- My study on the distance that motor vehicle drivers provide when passing cyclists (Beck *et al.* 2019, *Accident Analysis and Prevention*) was the largest study of its kind in the world and has had substantial global impact. In partnership with the Amy Gillett Foundation, we developed novel technology to quantify passing distance and demonstrated that current infrastructure (marked on-road bicycle lanes) reduced the distance that motorists provide when passing cyclists. Given the novelty of this work, we received significant local and international media attention (e.g USA, UK, Germany, Italy) and is now the most tweeted article in Accident Analysis and Prevention of all time. This study is being used to set priorities by the UK Parliament Environmental Audit Committee on the implementation of cycling infrastructure to reduce crash risk and enhance cycling participation. Furthermore, it has been used to prioritise cycling infrastructure investment by Transport for Greater Manchester (UK) in the 'Greater Manchester Walking and Cycling Investment Plan 2020'. Additionally, these findings have been presented by invitation to the Transport Accident Commission, Victorian Department of Transport and the City of Melbourne. It is currently being used to inform policy on minimum passing distance legislation in Victoria and being used to inform policy by Bicycle New South Wales.
- My studies on the crash characteristics of bicycle crashes (Beck *et al.* 2016, *Accident Analysis and Prevention*; and Beck *et al.* 2019 *Injury Prevention*) have been used by the Victorian Department of Transport, local government agencies and Western Australia Police to inform policy. These studies are currently being used by the International Road Assessment Program (iRAP) to develop assessment frameworks for cycling infrastructure (CycleRAP).
- My study investigating trends in the incidence and burden of serious road traffic injury in Victoria (Beck *et al.* 2017, *Medical Journal of Australia*) demonstrated that serious injury rates had not changed over a decade, and in fact, the absolute number of seriously injured cyclists more than doubled over the 10-year period. This study received significant media attention and was published with an accompanying editorial. The results of this study have been used to set road safety targets in Victoria, informed policy by Bicycle NSW and the Bicycle Institute of South Australia, and importantly, led to the development of a joint position statement by key cycling organisations across Australia (WeRide Australia, Amy Gillett Foundation, Cycling Australia, Bicycle QLD, Bike SA, Pedal Power Canberra, Bicycle NSW, Bicycle Network and West Cycle) to address these alarming increases in injury rates.
- My report on alcohol and other drugs in road transport deaths (Beck *et al.* 2019, Report for the Victorian Department of Transport) was presented by invitation to the Australian Government Federal Office of Road Safety and is being used to inform road safety policy in Victoria and nationally.
- My report on forecasting major trauma in Victoria (Beck *et al.* 2018, Report for the Victorian State Trauma Committee) is the first study in the world to spatially forecast future trauma events to inform injury prevention strategy and trauma system planning. This report is currently being used by the Victorian Department of Health to inform changes to the Victorian State Trauma System.
- My study on potentially preventable trauma deaths (Beck *et al.* 2019, *Injury*) was a comprehensive review of prehospital trauma deaths in Victoria. The findings of this review resulted in the Victorian Department of Health developing an action plan for key trauma partners (Ambulance Victoria, Adult Retrieval Victoria, health services) and the approach that I developed will be implemented by the Victorian State Trauma Committee as part of routine quality control.
- My PhD program of research (Beck *et al.* 2016, *Injury Prevention*; Beck *et al.* 2014, *Traffic Injury Prevention*; Beck *et al.* 2011, *Traffic Injury Prevention*) investigated mechanisms of injury and potential countermeasures for motor vehicle rear seat occupants. The findings of my PhD have been used to inform US

national road safety priorities by the United States National Transportation Safety Board (NTSB), the introduction of performance requirements for rear seat crash test dummies as part of the Australasian New Car Assessment Program (ANCAP) Frontal Offset Test, and the United Nations (UN) regulation on child restraint systems.

My leadership, skills, strong collaborative partnerships and my track record in translational research outcomes demonstrate my capacity to lead this critical body of work. I have proven skills in managing large projects, such as:

- Leading the largest global study of the lateral distance that motor vehicle drivers provide when passing cyclists. I led a multi-disciplinary international team to develop novel technology, implement GPS map-matching techniques, and conduct robust statistical modelling that has resulted in a step-change in our understanding of the role that infrastructure plays on cyclist safety.
- The Victorian State Trauma Registry (as Chief Investigator); a global leader in trauma registries that employees ~45 staff, routinely monitors trauma patients and long-term outcomes following trauma, and has strong, long-term relationships with the Transport Accident Commission and the Victorian Department of Health and Human Services.
- Leading a novel data linkage project of trauma and crash data (DE180100825) that brings together data from the Transport Accident Commission, Victorian Department of Transport, Victoria Police and Ambulance Victoria. In this project, I have established a steering committee that includes whole-of-government representation, in addition to local and international academics. Given the novelty of the data linkage and my ability to bring together a multitude of project partners, this project is now being used by the Australian Government Federal Office of Road Safety as a pilot project with the aim of rolling out an equivalent project nationally.

I also have been invited to sit on influential committees and working groups, that demonstrate my international standing and my ability to influence policy in cycling. These include:

- My role on the VicRoads (now Victorian Department of Transport) Expert Advisory Group for the development of Victoria's Walking and Cycling Data Framework and Action Plan. One of the critical outcomes of these reports was the need for enhanced cycling exposure data. This work has set the agenda for cycling data needs that will be used by the Victorian Department of Transport into the future. Furthermore, this work clearly demonstrates the need for this Discovery Project.
- My role on the Expert Working Group as part of the International Cycling Safety Conference. Here, I was invited to join a select group of world-leading cycling safety academics to set the future research agenda for cycling safety. One of the key outcomes of this meeting was the need for cycling exposure data globally.
- I have recently been appointed by Strava (the largest global social network for cyclists) as the Victorian Lead for Strava Metro (the data product of Strava). In this role, I lead the application of crowd-sourced Strava data to improve cyclist safety and engage with the Victorian Department of Transport and the Transport Accident Commission.
- I am regularly invited to contribute to Federal and State Government policy and data discussions, particularly related to cycling. For example, in partnership with WeRide Australia, I was recently asked to comment on data needs in road safety by the Federal Office of Road Safety and the Department of Infrastructure, Transport, Cities and Regional Development. This is being used to guide priority setting at a national level. To quote WeRide Australia, "Dr Beck is a nationally and internationally acknowledged expert" and "we rely on his expertise and support for the work that WeRide undertakes".

Summary

As a mid-career researcher, I have demonstrated that I am on a rapid upward trajectory, have developed critical collaborative relationships with government and cycling organisations, sit on influential committees and working groups, and I have brought together a world-leading multidisciplinary team for this project across multiple academic levels. My demonstrated research track-record, research impact, work with multidisciplinary teams, and my leadership skills will ensure that we will deliver a high-impact, cost-effective program of work that will lead to a significant advancement of knowledge in cycling. This project will create a world-first platform that will lead to reductions in the burden of injury and increases in cycling participation, thereby leading to improvements in population and environmental health.

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

My research focusses on the intersection between transport and health, with an emphasis on injury prevention in urban transport and injury epidemiology. It is grounded in state-of-the-art research methods and data linkage applied to significant societal problems, with a strong focus on cyclist safety. Applying my background skills in engineering to health and movement data, I identify emerging critical issues and develop innovative safety countermeasures. This is achieved through my ability to bring multidisciplinary teams together, lead them to solve global problems, and engage and partner with government, industry, practitioners and the community.

Since returning to academia in 2015, I have published 50 papers (an average of 12.5 publications per year) and 14 government reports. 90% of my publications have been in Q1 journals (an impact factor in the top 25% of their respective field) and in 71% of these publications, I have been first or senior author (current practice for authorship in my field is for the senior academic to go in last position on publications).

I have an h-index of 12 (Google Scholar; January 2020), which is particularly impressive given that nearly all of my papers (50 of 52) have been published in the last 5 years. These papers have been published in leading transport and health journals, including Accident Analysis and Prevention, Injury, Injury Prevention, the Medical Journal of Australia, and the Journal of Science and Medicine in Sport.

I have developed novel methods of data capture and analysis in cycling safety. For example, I developed unique methods for capturing detailed crash information from cyclists hospitalised for injury (Beck et al. 2016, Accident Analysis and Prevention; and Beck et al. 2019 Injury Prevention) that have received significant media attention, awards (Australasian College of Road Safety Peter Vulcan Award for Best Research Paper) and has informed policy. Additionally, I developed novel on-bike technology that measures the lateral passing distance of motor vehicles (Beck et al. 2019, Accident Analysis and Prevention) that has received substantial international attention, awards (International Cycling Safety Conference Award for Best Presentation), is now the most tweeted article in the journal of all time and is already being used to inform cycling policy globally. Furthermore, I have conducted the first study of the effectiveness of various on-road bicycle lane types through the use of various spatial data and Bayesian conditional autoregressive logit models (Morrison et al. 2019, Accident Analysis and Prevention; senior author). My work on trends in rates and burden of road transport injury (Beck et al. 2017, Medical Journal of Australia) used novel metrics to quantify, for the first time, the disability and health-costs of cycling-related injury.

My reports for Government have been highly influential. For example, my reports are being used to inform the Victorian Road Safety Strategy and the National Road Safety Priorities (Beck et al. 2019), inform the National Injury Prevention Strategy (Hunter et al. 2019), inform the design of the Victorian State Trauma System (Beck & Gabbe, 2019), inform trauma clinical guidelines (Beck & Cameron, 2017) and quality control processes (Beck et al. 2018).

I have also utilised alternative forms to communicate my research findings to lay audiences, practitioners and policy makers in my field. This includes my use of social media (1,352 Twitter followers), media (TV, radio, print and online) and presentations to Government, industry, and community and cycling groups.

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Ben Beck, Derek Chong, Jake Olivier, Monica Perkins, Anthony Tsay, Adam Rushford, Lingxiao Li, Peter Cameron, Richard Fry & Marilyn Johnson 2019, 'How much space do drivers provide when passing cyclists? Understanding the impact of motor vehicle and infrastructure characteristics on passing distance', *Accident Analysis & Prevention*, vol. 128, pp. 253–260, doi:10.1016/j.aap.2019.03.007 (Refereed Journal Article)

[2] * Christopher N. Morrison, Jason Thompson, Michelle C. Kondo & Ben Beck 2019, 'On-road bicycle lane types, roadway characteristics, and risks for bicycle crashes', *Accident Analysis & Prevention*, vol. 123, pp. 123–131, doi:10.1016/j.aap.2018.11.017 (Refereed Journal Article)

[3] * Ben Beck, Mark Stevenson, Stuart Newstead, Peter Cameron, Rodney Judson, Elton R. Edwards, Andrew Bucknill, Marilyn Johnson & Belinda Gabbe 2016, 'Bicycling crash characteristics: An in-depth crash investigation study', *Accident Analysis & Prevention*, vol. 96, pp. 219–227, doi:10.1016/j.aap.2016.08.012 (Refereed Journal Article)

[4] * Ben Beck, Mark R Stevenson, Peter Cameron, Jennie Oxley, Stuart Newstead, Jake Olivier, Soufiane Boufous & Belinda J Gabbe 2019, 'Crash characteristics of on-road single-bicycle crashes: an under-recognised problem', *Injury Prevention*, vol. 25, no. 5, pp. 448–452, doi:10.1136/injuryprev-2018-043014 (Refereed Journal Article)

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[6] * Ben Beck, Christina L. Ekegren, Peter Cameron, Elton R. Edwards, Andrew Bucknill, Rodney Judson, Richard Page, Raphael Hau, Mark Stevenson & Belinda J. Gabbe 2017, 'Predictors of recovery in cyclists hospitalised for orthopaedic trauma following an on-road crash', *Accident Analysis & Prevention*, vol. 106, pp. 341–347, doi:10.1016/j.aap.2017.06.019 (Refereed Journal Article)

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[8] * Anna Devlin, Ben Beck, Pam M. Simpson, Christina L. Ekegren, Melita J. Giummarra, Elton R. Edwards, Peter A. Cameron, Susan Liew, Andrew Oppy, Martin Richardson, Richard Page & Belinda J. Gabbe 2019, 'The road to recovery for vulnerable road users hospitalised for orthopaedic injury following an on-road crash', *Accident Analysis & Prevention*, vol. 132, pp. 105279, doi:10.1016/j.aap.2019.105279 (Refereed Journal Article)

[9] * Ben Beck, Janet E Bray, Peter A Cameron, D James Cooper & Belinda J Gabbe 2016, 'Trends in severe traumatic brain injury in Victoria, 2006–2014', *Medical Journal of Australia*, vol. 204, no. 11, pp. 407–407, doi:10.5694/mja15.01369 (Refereed Journal Article)

[10] * Ben Beck, Karen Smith, Eric Mercier, Belinda Gabbe, Richard Bassed, Biswadev Mitra, Warwick Teague, Josine Siedenburg, Susan McLellan & Peter Cameron 2019, 'Differences in the epidemiology of out-of-hospital and in-hospital trauma deaths', *PLOS ONE*, vol. 14, no. 6, pp. e0217158, doi:10.1371/journal.pone.0217158 (Refereed Journal Article)

Refereed Journal Articles

[1] Jia Ying Ang, Belinda Gabbe, Peter Cameron & Ben Beck 2019, 'Animal–vehicle collisions in Victoria, Australia: An under-recognised cause of road traffic crashes', *Emergency Medicine Australasia*, vol. 31, no. 5, pp. 851–855, doi:10.1111/1742-6723.13361

[2] Ben Beck, Karen Smith, Eric Mercier, Stephen Bernard, Colin Jones, Ben Meadley, Toby St Clair, Paul A. Jennings, Ziad Nehme, Michael Burke, Richard Bassed, Mark Fitzgerald, Rodney Judson, Warwick Teague, Biswadev Mitra, Joseph Mathew, Andrew Buck, Dinesh Varma, Belinda Gabbe, Janet Bray, Susan McLellan, Jane Ford, Josine Siedenburg & Peter Cameron 2019, 'Potentially preventable trauma deaths: A retrospective review', *Injury*, vol. 50, no. 5, pp. 1009–1016, doi:10.1016/j.injury.2019.03.003

[3] Ben Beck, Kane J. Middleton, Daniel C. Billing, Joanne N. Caldwell & Greg L. Carstairs 2019, 'Understanding Anthropometric Characteristics Associated With Performance in Manual Lifting Tasks', *Journal of Strength and Conditioning Research*, vol. 33, no. 3, pp. 755–761, doi:10.1519/jsc.0000000000002113

[4] Ben Beck, Peter A Cameron, Sandra Braaf, Andrew Nunn, Mark C Fitzgerald, Rodney T Judson, Warwick J Teague, Alyse Lennox, James W Middleton, James E Harrison & Belinda J Gabbe 2019, 'Traumatic spinal cord injury in Victoria, 2007–2016', *Medical Journal of Australia*, vol. 210, no. 8, pp. 360–366, doi:10.5694/mja2.50143

[5] Dunn, M.S., Beck, B., Simpson, P.M., Cameron, P.A., Kennedy, M., Maiden, M., Judson, R. & Gabbe, B.J. 2019, 'Comparing the outcomes of isolated, serious traumatic brain injury in older adults managed at major trauma centres and neurosurgical services: A registry-based cohort study', *Injury*, vol. 50, no. 9, pp. 1534-1539

[6] Noha Ferrah, Peter Cameron, Belinda Gabbe, Mark Fitzgerald, Kate Martin & Ben Beck 2019, 'Trends in the Nature and Management of Serious Abdominal Trauma', *World Journal of Surgery*, vol. 43, no. 5, pp. 1216–1225, doi:10.1007/s00268-018-04899-4

[7] Noha Ferrah, Peter Cameron, Belinda Gabbe, Mark Fitzgerald, Rodney Judson, Silvana Marasco, Tanya Kowalski & Ben Beck 2019, 'Ageing population has changed the nature of major thoracic injury', *Emergency Medicine Journal*, vol. 36, no. 6, pp. 340–345, doi:10.1136/emermed-2018-207943

[8] Jemma Keeves, Christina L. Ekegren, Ben Beck & Belinda J. Gabbe 2019, 'The relationship between geographic location and outcomes following injury: A scoping review', *Injury*, vol. 50, no. 11, pp. 1826–1838, doi:10.1016/j.injury.2019.07.013

[9] Eric Mercier, Etienne Laroche, Ben Beck, Natalie Le Sage, Peter A. Cameron, Marcel Émond, Simon Berthelot, Biswadev Mitra & Julie Ouellet-Pelletier 2019, 'Defibrillation energy dose during pediatric cardiac arrest: Systematic review of human and animal model studies', *Resuscitation*, vol. 139, pp. 241–252, doi:10.1016/j.resuscitation.2019.04.028

[10] Biswadev Mitra, Jordan Bade-Boon, Mark C. Fitzgerald, Ben Beck & Peter A. Cameron 2019, 'Timely completion of multiple life-saving interventions for traumatic haemorrhagic shock: a retrospective cohort study', *Burns & Trauma*, vol. 7, no. 1, doi:10.1186/s41038-019-0160-5

[11] Chatura Wijetunga, Chris O'Donnell, Tiffany Y So, Dinesh Varma, Peter Cameron, Michael Burke, Richard Bassed, Karen Smith & Ben Beck 2019, 'Injury Detection in Traumatic Death: Postmortem Computed Tomography vs. Open Autopsy', *Journal of Forensic Radiology and Imaging*, pp. 100349, doi:10.1016/j.jofri.2019.100349

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[17] Sandra Braaf, Ben Beck, Libby Callaway, Jennie Ponsford & Belinda J. Gabbe 2018, 'The Residential Status of Working Age Adults Following Severe Traumatic Brain Injury', *Brain Impairment*, vol. 19, no. 3, pp. 201–214, doi:10.1017/brimp.2018.3

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[20] Christina L. Ekegren, Ben Beck, Rachel E. Climie, Neville Owen, David W. Dunstan & Belinda J. Gabbe 2018, 'Physical Activity and Sedentary Behavior Subsequent to Serious Orthopedic Injury: A Systematic Review', *Archives of Physical Medicine and Rehabilitation*, vol. 99, no. 1, pp. 164–177.e6, doi:10.1016/j.apmr.2017.05.014

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[28] Ben Beck, Kane J. Middleton, Greg L. Carstairs, Daniel C. Billing & Joanne N. Caldwell 2016, 'Predicting stretcher carriage: Investigating variations in bilateral carry tests', *Applied Ergonomics*, vol. 55, pp. 124–132, doi:10.1016/j.apergo.2016.02.002

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[30] Ben Beck, Hideo Tohira, Janet E Bray, Lahn Straney, Elizabeth Brown, Madoka Inoue, Teresa A. Williams, Nicole McKenzie, Antonio Celenza, Paul Bailey & Judith Finn 2016, 'Trends in traumatic out-of-hospital cardiac arrest in Perth, Western Australia from 1997 to 2014', *Resuscitation*, vol. 98, pp. 79–84, doi:10.1016/j.resuscitation.2015.10.015

[31] Ben Beck, Janet E Bray, Karen Smith, Tony Walker, Hugh Grantham, Cindy Hein, Melanie Thorrowgood, Anthony Smith, Madoka Inoue, Tony Smith, Bridget Dicker, Andy Swain, Emma Bosley, Katherine Pemberton, Michael McKay, Malcolm Johnston-Leek, Peter Cameron, Gavin D Perkins & Judith Finn and 2016, 'Description of the ambulance services participating in the Aus-ROC Australian and New Zealand out-of-hospital cardiac arrest Epistry', *Emergency Medicine Australasia*, vol. 28, no. 6, pp. 673–683, doi:10.1111/1742-6723.12690

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Fully Refereed Conference Proceedings

[1] Beck, B., Brown, J. & Bilston, L.E. 2012, 'Objective measures for determining submarining and abdominal injury in hybrid III crash test dummies', *2012 IRCOBI Conference Proceedings - International Research Council on the Biomechanics of Injury*, pp. 597

F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

No

Part F - Participant Details including ROPE (Prof Christopher Pettit)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Chief Investigator

Title

Prof

First Name

Christopher

Second Name

James

Family Name

Pettit

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
13/07/2003	Doctoral Degree	Doctor of Philosophy	Planning	The University of Queensland	Australia
15/11/1999	Masters Degree	Master of Regional and Town Planning	Urban Planning	The University of Queensland	Australia
02/04/1997	Bachelor Honours Degree,Graduate Certificate, Graduate Diploma	Graduate Diploma in Geographical Information Sciences	Geomatics	The University of Queensland	Australia
13/12/1995	Bachelor Degree	Bachelor of Regional and Town Planning	Urban Planning	The University of Queensland	Australia

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

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F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area** (Yes/No)	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
Boufous S, Ivers R, Macniven R, **Pettit C**, Beck B. 'Cycling, Mobility and Safety in Older People'. *UNSW Ageing Futures Institute Seed Research Grant.* 2020.	Y	C		50						
Pettit,C, Han, H. Randolph, B. Bain, M. Sammut, C. Value Australia - Sharpening our land and property decisions with Artificial Intelligence CRC-P Round 6 2019-2022	N	C		1,000	1,000	500				

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.1

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of New South Wales	Yes	Employee	1.0

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

The University of New South Wales

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

Identifier	Investigators	Admin Organisation	Project Title	Funding	End Date	Final Report Due Date	Final Report Status

LE190100201	Prof Dr Peter Newton ; Prof Mark Burry ; Prof Christopher Pettit ; Prof Carl Grodach ; Prof Gregory Morrison ; Prof Jurg Keller ; Prof Shane Murray ; A/Prof Matthias Haeusler ; Prof Marcus White ; Dr Christian Urich ; Prof Hussein Dia ; Prof Andrew Rohl ; Dr Xin Liu ; A/Prof Steven Kenway ; Dr Badin Gibbes	Swinburne University of Technology	iHUB: a smart urban research-synthesis-engagement platform for decision making	$725,405	31/12/2019	31/12/2020	Draft

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

Yes

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should this application be successful the participant will exceed ARC project limits and must meet the project limits under

the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

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F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Professor - Urban Science	Faculty of Built Environment	Permanent	Full Time	04/05/2015		The University of New South Wales

Associate Professor	Architecture Building and Planning	Contract	Full Time	01/09/2011	17/04/2015	The University of Melbourne
Research Manager - Spatial Information Sciences	Department of Primary Industries	Permanent	Full Time	01/09/2004	01/09/2011	Victorian State Government

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

No

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

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F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

I graduated with Ph.D. in planning from the University of Queensland in 2003, 15 years ago. During that period, I have remained an active researcher with no career interruptions.

Research Opportunities

In 2002 and for the two years (2003-2004) I held a post-doctoral position at RMIT University, at which time I published a series of papers on geographical visualisation techniques for use as a participatory planning support tool. I was a CI on an ARC network grant for Spatial Integrated Social Science (ARCNSISS), and I was awarded various internal research grants.

In 2004, I took up a full-time position in the Victorian Department of Primary Industries in research management where I stayed until 2011. In this role, I managed a team of 30 scientists, and technical staff focused on geospatial applications to planning decision making in Victoria. I contributed to the formulation of government policy, hosted workshops and forums and oversaw data collection of spatial information across a range domains for application to multiple research projects and applications areas. I have led many research projects that explored landscape systems using geographical visualisation and spatial analysis techniques for both simulating landscape futures and communicating the findings to decision-makers. I led the establishment of a 3D object library comprising vegetation and built infrastructure objects to test "what if?" type land use planning and design questions by presenting change scenarios in 3D flyby digital displays. This work has been published in several leading journals, forming a firm foundation on which to implement key research components of this proposal.

From 2004 to 2011, while employed by the State Government of Victoria (0.4 FTE Administration role), I endeavoured to remain research active by:

• Co-authoring approx. 50 refereed papers.

• Participating as a Principal Investigator (PI) and linkage partner on an ARC Linkage project entitled "Automating and integrating spatial data and metadata processes" (2008-2011)

• Chairing the International ISPRS II/6 Working Group on Geographical Visualisation and Virtual Reality. I have also been a member of the International Advisory Board of the Open Source Geo Laboratories Network (the ICA-OSGeo Labs initiative) with 100 labs globally.

Between 2011- 2015 I led the University of Melbourne's ICA-OSGeo Lab on Sustainable Cities, and I coordinated the urban informatics course. I held an appointment as Associate Professor in the Faculty of Architecture, Building and Planning, where I supervised four Ph.D. students. However, my primary role at the University was as the strategic implementation coordinator for the Australian Urban Research Infrastructure Network (AURIN) project. AURIN is a $24 million initiative funded by the Australian Government's Super Science scheme. My role is as coordinator of implementation of the e-infrastructure program, which comprises a suite of datasets and tools to support urban research across Australia. My time allocation was approximately 60 percent in management-administrative responsibilities for the AURIN project, 10 percent in teaching and 30 percent in research. The knowledge gained regarding AURIN tools and datasets will be a valuable asset to the project.

Since May 2015, I have been appointed Professor of Urban Science at the University of New South Wales. I am Director of the City Analytics Program and Associate Director City Futures Research Centre. My current role is research (60%) teaching (20%) and and administration (20%).

Regarding teaching, I am the Discipline Director of the City Analytics Program and course coordinator for 'Digital Cities' and 'Geodesign'. Regarding research, I am currently undertaking research into structural measures of liveability (CI and funded through 2 NHMRC grants), and research into bottlenecks in the adoption of planning support systems in practice (CI, funded through CRC-SI research grant). I am an international advisory board member for the "Geo for All" initiative and chair of the Research Data Alliance (RDA) International Working Group on Urban Quality of Life Indicators and the International Society for Photogrammetry and Remote Sensing (ISPRS) working group on Geographical Visualization and Virtual Reality.

I have been fortunate to receive mentoring from some esteemed colleagues over the years. This include mentoring in the areas of (1) planning support systems by Emeritus Professor Richard Klosterman, (2) urban geography by Emeritus

Professor Robert Stimson, (3) city science and urban modelling by Emeritus Professor Michael Batty, (4) Cartography by Emeritus Professor William Cartwright and (5) landscape visualisation by Emeritus Professor Ian Bishop.

The University of New South Wales, Urban is a highly respected University of international standing. Specifically, the City Futures Research Centre is of significant international reputation situated in the Faculty of Built Environment, where the urban planning program is only one of two programs in the Country with an ERA of 5. The research facilities the research team will have access to include GIS and data visualisation. I have recently received funding to establish a geographical visualisation and virtual reality laboratory which will directly beneficial this research proposal.

The university is also part of the newly launched PLuS Alliance, a unique partnership between UNSW, King's College London, and Arizona State University. The City Futures Research Centre's involvement in this partnership has paved the way for international participation of three of the other investigators in this proposal.

Research Achievements and Contributions

I have extension experience and knowledge in the field of planning support science which is essentially the intersection of planning and geographical information systems. I am an internationally recognised research leader who bring extensive skill in managing significant large research project including the Australian Urban Research Infrastructure Network (AURIN).

My research contributions have yielded a number of honours and awards, speaking opportunities, and recognition beyond academia. The most recent evidence of this is my contribution as CI to the Rapid Analytics Interactive Scenario Exploration (RAISE) project, which is founded on collaboration with local government and industry partners. The outcome of the RAISE project was a spatial data toolkit that would benefit the workflows of city planners and land valuers. The toolkit provides a framework for integrating rich and diverse datasets with open source tools in order to produce spatial insight and visualisation that can support collaborative analysis. In 2017, it won Best Industry-led Partnership in the Committee for Sydney's Smart City Awards.

Leading this project has benefited my appreciation of the current challenges and opportunities urban systems face in improving city data and analytics. This added knowledge will benefit the proposal as the issue of data and analytical capacities is a major component of our investigation.

Recent Invited keynote and speaker addresses:

• 'Reinventing Delhi' International Conference (2019) Delhi, India.

• Smart & Shrinking Cities: International Perspective (2019) 23 Feb, Osaka, Japan.

• City Analytics, Smart cities and sustainability (2018) 10th GRIHA Summit, Delhi, India, Dec 11-13th

• Rapid Analytics and Big Data 15th International Conference of Computer in Urban Planning and Urban Management (2017), South Australia, 11-14th July.

• Australian Population Conference (2016) How can we leverage big data in planning and managing our cities? Sydney 29th Nov to 2nd of Dec.

• Smart Futures Cities (2016) The Role of Spatial Data and Urban Analytics, "Visualising a Changing City "University of Melbourne, Melbourne.

• Bike Future (2016), Mapping cycling journeys through Australian cities, 7th of Sept.

• FOSS4G Korea (2016) Smart City with Open Geospatial Technologies in Emerging Cities, "Using the Online What if? Scenario Planning Tool for City Planning, Seoul Korea, 31st of August – 2nd of Sept.

• Understanding the City with Urban Informatics (2015) Using an Online Spatial Analytics Workbench for Understanding Changing Housing Markets across Australian Cities, UCUI 2015

• Open Cities – Open Data Workshop (2015) "On the Completeness of Open City Data for Measuring City Indicators" UNSW Smart Cities Cluster, Sydney.

• 47th Urban and Regional Information System Association (URISA) Conference (2008) New Orleans, United States.

• ISPRS WG II/4 Workshop (2005) Spatial Planning and Decision Support Systems Joint International Society of Photogrammetry and Remote Sensing (ISPRS), University Putra Malaysia (UPM) Malaysian Centre for Remote Sensing (MACRES) and Malaysian Remote Sensing Society (MRSS).

Research Support income:

I am an active national and international researcher. During my academic career I have completed four Australian Research Council grants and two National Health and Medical Research Council grants. Over the last 4 years I have been successful in receiving funding for 40 competitive grants worth over $3million.

Identifiable benefits outside of academia:

I have worked with a number of councils and state government agencies across Australia in supporting them in the formulation of strategic plans. This work has predominantly been aided through the use of GIS and planning support system tools and system thinking approaches to assist them envision and explore a number of what if? future growth scenarios. I have worked with Department of Planning in Western Australia in formulating and testing assumptions in the Perth to Peel Strategy and more recently with the Greater Sydney Commission in assisting them in formulating collaboration areas plans. In the emerging domain of Smart Cities I have been working with Councils in providing them advice in the formulation of Smart City Strategies.

Research impacts and advancement of knowledge:

In 2018 I launched the City Analytics Lab (CAL) the first lab of its kind in the world to support and study group decision-making behaviour. The Lab comprise a number of interactive screens which networked to enable participants to explore models and simulations. CAL will be utilised as part of this ARC Discovery Project to run workshops and user testing experiments for the PSS-Dashboard. The lab has received nearly 100 tours and workshop since it was opened by the Federal Minister of Cities in May 2018.

Other professional activities:

I am currently Chair of the Board for Computers in Urban Planning and Urban Management. After serving two years (2016-2018) as Associated Editor for the International Journal Computers Environment and Urban Systems. I am now on the editorial board. I also on the Editorial Board for the International Journal Applied Spatial Analysis and Policy

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

Publication context and contributions
In field of urban studies CI Pettit is widely published. The current practice for authorship in CI Pettit's field of urban studies is for the senior academic to go in last position on publications where research with students is undertaken. Hence CI Pettit has a number of publications where is both first author and last author.

Esteem factors used for publications
CI Pettit's work is reported in more than 150 published scholarly articles and 3 books. The high impact of my papers is evidenced by citations:
• Scopus lists 219 citations for my papers, giving me an h-index of 17 (15 papers cited 15 or more times) (sourced: 15th Jan 2020)
• Google Scholar lists 2,194 citations, resulting in an h-index of 23 (sourced: 15th Jan 2020).

CI Pettit's publications include more than 45 international journal articles in top ranked journals in the field of urban studies including: Computer Environment and Urban Systems, Landscape and Urban Planning, Environment and Planning B, Landscape Ecology, Computer Environment and Urban Systems. I am currently Associated Editor for Computers Environment and Urban Systems, the number 1 journal in the world for Urban Studies.

CI Pettit's training commenced in urban and regional planning with a focus on the use of geographical information systems to create digital maps and spatial decision support systems, also known as planning support systems (PSS). The barrier for adoption of digital outputs for city planning and response has been a research challenge which has become a key focus of CIs Pettit's work and where he will contribute significantly to this ARC linkage project, leading the mapping and visualisation work package. He has been a CI on a number of projects which have built mapping and visualisation infrastructure to support city planning and policy-making. For example, a recently completed project built and deployed a city datastore as part of an ARC LIEF grant (LE160100174) which has been redeployed to support city planning efforts in Phoenix and in London. CI Pettit has led an international collaborative project with Kings College London, which has produced some air quality maps across Sydney and made these available to policy and decision-makers through this ARC LIEF infrastructure.

Recently CI Pettit established the City Analytics Lab, which is the first of its kinds in the world which support co-design and evaluation of PSSs. The Lab was designed by CI Pettit and include 6 interactive large screens in the main room with four smaller rooms comprising AR and VR equipment. The Lab is configured to support user evaluations and experiments with one way glass to support participant observation. The lab also including eye tracking equipment to support the detailed analysis of participants who interact with data assisted tools. The City Analytics Lab will provide an important facility to support the develop and testing of the city wide model of cycling with planners and policy makers in Sydney as part of this ARC Discovery project.

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Leao, SZ, Lieske, SN & Pettit, CJ 2017, 'Validating crowdsourced bicycling mobility data for supporting city planning', *Transportation Letters*, pp. 1–12, doi:10.1080/19427867.2017.1401198 (Refereed Journal Article)

[2] * Leao, S, Lieske, S, Conrow, L, Doig, J, Mann, V & Pettit, C 2017, 'Building a National-Longitudinal Geospatial Bicycling Data Collection from Crowdsourcing', *Urban Science*, vol. 1, pp. 23–23, doi:10.3390/urbansci1030023 (Refereed Journal Article)

[3] * Conrow, L, Wentz, E, Nelson, T & Pettit, C 2018, 'Comparing spatial patterns of crowdsourced and conventional bicycling datasets', *Applied Geography*, vol. 92, pp. 21–30, doi:10.1016/j.apgeog.2018.01.009 (Refereed Journal Article)

[4] * Scott N Lieske, Simone Z Leao, Lindsey Conrow & Chris Pettit 2019, 'Assessing geographical representativeness of crowdsourced urban mobility data: An empirical investigation of Australian bicycling', *Environment and Planning B: Urban Analytics and City Science*, pp. 239980831989433, doi:10.1177/2399808319894334 (Refereed Journal Article)

[5] * Pettit, CJ 2005, 'Use of a Collaborative GIS-based Planning Support System to assist in Formulating a Sustainable Development Scenario for Hervey Bay', *Environment and Planning B: Planning and Design*, vol. 32, pp. 523–545, doi:10.1068/b31109 (Refereed Journal Article)

[6] * Pettit, CJ, Raymond, CM, Bryan, BA & Lewis, H 2011, 'Identifying strengths and weaknesses of landscape visualisation for effective communication of future alternatives', *Landscape and Urban Planning*, vol. 100, pp. 231–241, doi:10.1016/j.landurbplan.2011.01.001 (Refereed Journal Article)

[7] * Pettit, C, Bakelmun, A, Lieske, SN, Glackin, S, Hargroves, K, Thomson, G, Shearer, H, Dia, H & Newman, P 2018, 'Planning support systems for smart cities', *City, Culture and Society*, vol. 12, pp. 13–24, doi:10.1016/j.ccs.2017.10.002 (Refereed Journal Article)

[8] * Pettit, C, Hawken, S, Zarpelon, SL, Ticzon, C, Afrooz, AE, Steinitz, C, Ballal, H, Canfield, T & Lieske, S 2019, 'Breaking Down The Silos Through Geodesign – Envisioning Sydney's Urban future', *Environment and Planning B: Urban Analytics and City Science (Special Issue on Urban Systems Design: from "Science for Design" to "Design in Science)* (Refereed Journal Article)

[9] * Pettit, CJ, Tanton, R & Hunter, J 2016, 'An online platform for conducting spatial-statistical analyses of national census data across Australia', *Computers, Environment and Urban Systems*, doi:10.1016/j.compenvurbsys.2016.05.008 (Refereed Journal Article)

[10] * Li, S, Dragicevic, S, Castro, FA, Sester, M, Winter, S, Coltekin, A, Pettit, C, Jiang, B, Haworth, J, Stein, A & Cheng, T 2016, 'Geospatial big data handling theory and methods: A review and research challenges', *ISPRS Journal of Photogrammetry and Remote Sensing*, vol. 115, pp. 119–133, doi:10.1016/j.isprsjprs.2015.10.012 (Refereed Journal Article)

Edited Books

[1] * Scott Hawken, Hoon Han & Chris Pettit (eds.) 2020, 'Open Cities | Open Data', Springer Singapore, doi:10.1007/978-981-13-6605-5

[2] * Geertman, S, Zhan, Q, Allan, A & Pettit, C 2019, 'Computational Urban Planning and Management for Smart Cities', Springer International Publishing, doi:10.1007/978-3-030-19424-6

[3] Reed, Richard & Pettit, Christopher 2018, 'Real Estate and GIS: The Application of Mapping Technologies', vol. 1, Routledge

[4] * Geertman, Stan, Allan, Andrew, Pettit, Christopher & Stillwell, John 2017, 'Planning Support Science for Smarter Urban Futures', Springer International Publishing, doi:10.1007/978-3-319-57819-4

[5] Christopher Pettit, William Cartwright, Ian Bishop, Kim Lowell, David Pullar & David Duncan (eds.) 2008, 'Landscape Analysis and Visualisation', Springer Berlin Heidelberg, doi:10.1007/978-3-540-69168-6

Book Chapters

[1] * Giles-Corti, B, Gunn, L, Hooper, P, Boulange, C, Diomedi, BZ, Pettit, C & Foster, S 2019, 'Built Environment and Physical Activity' in Nieuwenhuijsen, M & Khreis, H (eds.), *Integrating Human Health into Urban and Transport Planning A Framework*, Springer, pp. 347–381, doi:10.1007/978-3-319-74983-9

[2] Tomko, M, Galang, G, Bayliss, C, Koetsier, J, Greenwood, P, Voorsluys, W, Mannix, D, Sarwar, S, Widjaja, I, Pettit, C & Sinnott, R 2019, 'Designing Adaptable Spatial Cyberinfrastructure for Urban eResearch' in Wang, S & Goodchild, MF (eds.), *CyberGIS for Geospatial Discovery and Innovation*, Springer, pp. 53–69, doi:10.1007/978-94-024-1531-5

[3] Eslami Afrooz, A, Lowe, R, Zarpelon Leao, S & Pettit, C 2018, '3D and Virtual Reality for Supporting Redevelopment Assessment' in Reed, R & Pettit, C (eds.), *Real Estate and GIS The Application of Mapping Technologies*, Routledge, pp. 162–185

[4] Lieske, SN, van den Nouwelant, RM, Han, H & Pettit, C 2018, 'Modelling Value Uplift on Future Transport Infrastructure' in Reed, R & Pettit, C (eds.), *Real Estate and GIS: The Application of Mapping Technologies*, Routledge, pp. 80–98

[5] Pettit, C, Ticzon, C, Reades, J, Wentz, EA, Ong, P, Martin, C, Troy, L & Crommelin, L 2018, 'How Disruptive Technology is Impacting the Housing and Property Markets: An Examination of Airbnb' in Reed, R & Pettit, C (eds.), *Real Estate and GIS: The Application of Mapping Technologies*, Routledge, pp. 36–64

[6] Randolph, B, Eslami Afrooz, A & Pettit, C 2018, 'Residential Intensification and Housing Demand: A Case Study of Sydney, Brisbane and Melbourne' in Reed, R & Pettit, C (eds.), *Real Estate and GIS: The Application of Mapping Technologies*, Routledge, pp. 12–35

[7] Zarpelon Leao, S, Gaudou, B & Pettit, C 2018, 'An Agent-based Model for High-density Urban Redevelopment Under Varied Market and Planning Contexts' in Reed, R & Pettit, C (eds.), *Real Estate and GIS: The Application of Mapping Technologies*, Routledge, pp. 116–139

[8] * Boulange, C, Pettit, C & Giles-Corti, B 2017, 'The Walkability Planning Support System: An Evidence-Based Tool to Design Healthy Communities' in Geertman, S, Allan, A, Pettit, C & Stillwell, J (eds.), *Planning Support Science for Smarter Urban Futures*, Springer, pp. 153–165, doi:10.1007/978-3-319-57819-4_9

[9] Geertman, S, Allan, A, Pettit, C & Stillwell, J 2017, 'Introduction to "Planning Support Science for Smarter Urban Futures"' in Geertman, S, Allan, S, Pettit, C & Stillwell, J (eds.), *Planning Support Science for Smarter Urban Futures*, Springer, pp. 1–19, doi:10.1007/978-3-319-57819-4

[10] * Goodspeed, R, Pelzer, P & Pettit, C 2017, 'Planning our Future Cities: The Role Computer Technologies Can Play' in Sanchez, T (ed.), *Planning Knowledge and Research*, Routledge (Taylor & Francis), pp. 210–226, doi:10.4324/9781315308715

[11] * Leao, SZ & Pettit, C 2017, 'Mapping Bicycling Patterns with an Agent-Based Model, Census and Crowdsourced Data' in Namazi-Rad, M-R, Padgham, L, Perez, P, Nagel, K & Bazzan, A (eds.), *Agent Based Modelling of Urban Systems First International Workshop, ABMUS 2016, Held in Conjunction with AAMAS, Singapore, Singapore, May 10, 2016, Revised, Selected, and Invited Papers*, Springer, pp. 112–128, doi:10.1007/978-3-319-51957-9_7

[12] * Pettit, C & Zarpelon Leao, S 2017, 'Dashboard' in Schintler, L & McNeely, C (eds.), *The Encyclopedia of Big Data*, Springer, pp. 1–7, doi:10.1007/978-3-319-32001-4_295-1

[13] * Pettit, C, Tice, A & Randolph, B 2017, 'Using an Online Spatial Analytics Workbench for Understanding Housing Affordability in Sydney', *SEEING CITIES THROUGH BIG DATA: RESEARCH, METHODS AND APPLICATIONS IN URBAN INFORMATICS* in Thakuriah, P, Tilahun, N & Zellner, M (eds.), *SEEING CITIES THROUGH BIG DATA: RESEARCH, METHODS AND APPLICATIONS IN URBAN INFORMATICS*, SPRINGER INTERNATIONAL PUBLISHING AG, pp. 233–255, doi:10.1007/978-3-319-40902-3_14

[14] * Zarpelon Leao, S, Huynh, N, Taylor, A, Pettit, C & Perez, P 2017, 'Evolution of a Synthetic Population and Its Daily Mobility Patterns Under Spatial Strategies for Urban Growth' in Geertman, S, Allan, A, Pettit, C & Stillwell, J (eds.), *Planning Support Science for Smarter Urban Futures*, Springer, pp. 399–417, doi:10.1007/978-3-319-57819-4_22

[15] * Pettit, CJ, Tice, A & Randolph, B 2016, 'Using an Online Spatial Analytics Workbench for Understanding Housing Affordability in Sydney' in Thakuriah, P, Tilahun, N & Zellner, M (eds.), *Seeing Cities Through Big Data: Research, Methods and Applications in Urban Informatics*, Springer International Publishing, pp. 233–255, doi:10.1007/978-3-319-40902-3

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F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

No

Part F - Participant Details including ROPE (Dr Meead Saberi)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Chief Investigator

Title

Dr

First Name

Meead

Second Name

Family Name

Saberi

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
09/09/2013	Doctoral Degree	Doctor of Philosophy	Civil & Environmental Engineering	Northwestern University	United States of America
11/12/2010	Masters Degree	Master of Science	Civil & Environmental Engineering	Portland State University	United States of America
01/08/2007	Bachelor Degree	Bachelor of Science	Civil & Environmental Engineering	Ferdowsi University of Mashhad	Iran

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

Uploaded PDF file follows on next page.

F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area** (Yes/No)	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
Saberi, Waller, Jian, Moylan. *Travel Time Reliability Measurement Research.* Transport for NSW 2019	Y	C		12						
Gu, **Saberi**. *Mapping Urban Greenery and Noise in Sydney with Crowdsourced Mobile Data.* City of Sydney 2019	Y	C		5						

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.1

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of New South Wales	Yes	Employee	1

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

The University of New South Wales

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

Yes

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should this application be successful the participant will exceed ARC project limits and must meet the project limits under the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

No PDF file uploaded.

F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Senior Lecturer	School of Civil and Environmental Engineering	Permanent	Full Time	15/02/2018		The University of New South Wales
Lecturer	Civil Engineering	Permanent	Full Time	03/02/2014	14/02/2018	Monash University

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

Yes

From when

01/09/2013

To when

01/02/2014

FTE of academic interruption

1.0

Interruption Category

Unemployment

Details

International move from USA to Australia

From when

01/07/2019

To when

30/09/2019

FTE of academic interruption

1.0

Interruption Category

Caring Responsibilities

Details

I took 3 months of parental leave from July-September 2019.

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

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F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

I was awarded my PhD degree 7 years ago in 2013 in Civil & Environmental Engineering (Transportation Systems Analysis and Planning) from Northwestern University, USA.

I have experienced a total of 6 months (at 1.0 FTE) of academic interruptions due to international move from the US in Australia in 2014 and parental leave in 2018.

Research Opportunities

• I have moved from the US to Australia in 2014. From September 2013 to February 2014, I was unemployed and in transition between the two countries.

• I have one child, born in 2018, and took 3 months parental leave from July-September.

• From February 2014 until February 2018, I was a lecturer (FTE 1.0, level B – continuing) in the Civil Engineering Department at Monash University. My main research areas include traffic flow theory and characteristics and transport network modelling.

• Since February 2018, I have joined the School of Civil and Environmental Engineering at the University of New South Wales (UNSW) as a senior lecturer (FTE 1.0, level C – continuing).

• My time is currently apportioned to approximately 50% research, 40% teaching, and 10% administration.

• I am currently supervising 5 PhD students at UNSW and acting as an external co-supervisor of one PhD student at Monash University. The PhD students at Monash University was my former student. Given my move to UNSW, my role has changed from the main supervisor to external co-supervisor. In total, in the last five years, I have been a supervisor and co-supervisor of a total of 10 PhD students including 3 PhD completions.

• At UNSW, I am part of the Research Centre for Integrated Transport Innovation (rCITI), working closely with Prof Travis Waller as a mentor and collaborator. Also, the transport research group at UNSW is a well-known and well-established group in Australia and internationally with a strong ARC track record.

Research Achievements and Contributions

Background:

My research in traffic flow theory and network traffic dynamics and modelling has had significant impact on international research community. More specifically during the past several years, I have extensively worked on understanding dynamics and modelling of large-scale transport networks in the contexts of Macroscopic Fundamental Diagram (MFD) or Network Fundamental Diagram (NFD) and Simulation-based Dynamic Traffic Assignment (DTA). My both directions of research in traffic flow theory and largescale network modelling have provided me with a solid knowledge and expertise in analysing and understanding of complex transport systems.

Outputs:

I have published 43 refereed journal papers in well-recognised journals including Proceedings of the National Academy of Science (PNAS), Scientific Reports, Transportation Research Part B, Transportation Research Part C, Networks and Spatial Economics, Physica A, Transportation Research Record, Journal of Transportation Geography, Transportation (Springer), etc. I currently have a total of 653 citations with h-index of 15, according to Scopus and a total of 1,189 citations with h-index of 19 according to Google Scholar.

National and international collaboration:

In the past several years, I have been collaborating with a number of internationally recognised scholars in traffic flow theory and network modelling including Prof Hani Mahmassani (my former PhD supervisor) from Northwestern University, Prof Majid Sarvi at University of Melbourne, A/Prof Nikolas Geroliminis from EPFL Swtizerland, A/Prof Marta Gonzales from University of California at Berkeley (formerly at MIT), Dr. Mohsen Ramezani at University of Sydney and Dr. Ali Zockaie and Dr. Mehrnaz Ghamami at Michigan State University. As a result, I have published a number of joint papers in international conferences and journals.

Research support income:

During the past five years, I have attracted a total of $796,500 external research funding from industry (as lead CI and non-lead CI) and a total of $150,000 internal seed grants. I have not yet been able to attract an ARC funded grant yet.

Supervision:

During the past five years, I have supervised and co-supervised 3 postdoctoral research fellows, 10 PhD students, 25 Master's students and 30+ undergraduate final year projects.

Prizes, honours and awards:

I am the recipient of the "Dwight David Eisenhower Transportation Fellowship" from the U.S. Department of Transportation in 2010. I was awarded the "Outstanding Graduate Student of the Year" from the Civil and Environmental Engineering Department, Portland State University in 2010. In 2011, I received the 19th International Symposium on Transportation and Traffic Theory (ISTTT) Student Fellowship Award from the University of California, Berkeley. In 2014, I received the Vice-Chancellor's Social Inclusion Award (Certificate of Appreciation) from Monash University. In 2014, I was a finalist nominated for the Intelligent Transportation Systems (ITS) Australia National Award in Research Academic category. In 2015, I received 1st Prize for the Best Data Journalism Hack in GovHack, the largest open data hackathon in Australia. In 2017, I was the recipient of the "leadership award" from the Traffic Flow Theory and Characteristics Committee of the Transportation Research Board (TRB) of the U.S. National Academies.

Invited keynotes and speakers addresses:

o "Pedestrian Traffic Flow Characteristics", University of Sydney, May 28, 2019.

o "Intelligent Transport Systems: Advanced Transport Modelling and Big Data", University of Sydney, June 5, 2018.

o "Value of Visualisation and Simulation in Better Understanding Transport Problems", AITPM 2018 Kick off, Young Professionals Network, SMEC, March 15, 2018.

o "DynaMel: A Large-Scale Simulation-Based Dynamic Traffic Assignment Model of Melbourne", AIMSUN User's Meeting, Brisbane, December 7, 2017.

o "DynaMel: A Large-Scale Simulation-Based Dynamic Traffic Assignment Model of Melbourne", ARRB, September 22, 2017.

o "Transportation Networks", UrbaNet satellite workshop at NetSci 2017, Indianapolis, USA, June 2017.

o "Urban Data Analytics and Visualization", University of South Florida, February 2017.

o "Big Data, Big Models: Harnessing the Power of Big Data in Large-Scale Transportation Infrastructure Modeling", University of New Hampshire, February 2017.

o "Big Data, Big Models: Harnessing the Power of Big Data in Large-Scale Transportation Infrastructure Modeling", Florida Atlantic University, February 2017.

o "Data-Driven Smart Cities", Texas Transportation Institute, Texas A&M University, College Station, January 28, 2016.

o "Urban Informatics, Analytics, and Visualization: Towards Data-driven Cities", Workshop on Smart Mobility, Swinburne University of Technology, Melbourne, November 17, 2015.

o "Urban Informatics, Analytics, and Visualization: Towards Data-driven Cities", Urban Informatics Course/Workshop, University of Melbourne, September 29, 2015.

o "How Big Data Helps Build Community Resilience?", Advancing Community-Led Resilience, Monash Disaster Resilience Forum, Monash Injury Research Institute, July 30, 2015.

o "Towards Data-Driven Smart Cities: Application of Complexity Science and Big Open Data Analytics and Visualization in Understanding Cities", ITS Australia Summit, May 14, 2015.

o "Transport Infrastructure Innovation: From Crowd-sourcing to Cloud Data Hosting", ITS Australia Summit, May 13, 2015.

o "Big & Open Data Visualization and Analytics: Towards Data Driven Cities", VicRoads, April 21, 2015.

o "Towards Data-Driven Cities: Application of Big and Open Data Analytics and Visualization in Understanding Cities", Monash University Accident Research Center (MUARC), March 10, 2015.

o "Developing an Integrated Transportation Infrastructure Decision Support Platform: Focusing on Big and Open Data Analytics and Visualization", California Polytechnic State University at San Luis Obispo, February 1, 2015.

o "Developing an Integrated Transportation Infrastructure Decision Support Platform: Focusing on Big and Open Data Analytics and Visualization", University of Illinois at Chicago, January 29, 2015.

o “Developing an Integrated Transportation Infrastructure Decision Support Platform: Focusing on Big and Open Data Analytics and Visualization”, Northwestern University, January 27, 2015.

o “Current Research Activities at Monash University: City Science Research Group”, University of Queensland, November 28, 2014.

o “Non-Stop versus Connecting Flights: Understanding Airline Network Structure”, Department of Civil Engineering, Monash University, May 16, 2014.

o “The Physics of Traffic in Urban Networks”, Department of Civil Engineering, Monash University, March 7, 2014.

o “Empirical Characterization and Interpretation of Hysteresis and Capacity Drop Phenomena in Freeway Networks”, TRB Committee of Traffic Flow Theory & Characteristics Webinar Series, May 17, 2013.

o “Investigating Speed-Flow Relationships for Planning Applications”, TRB Committee of Traffic Flow Theory & Characteristics Webinar Series, June 8, 2010.

Media outreach:

o Herald Sun, March 5, 2018, “Residents in suburbs with affordable housing plagued by high transport cost”.

o Herald Sun, June 20, 2016, “Congestion tax ‘only way’ to ease the squeeze on Melbourne’s roads, experts say”.

o ABC News Radio Interview, April 11, 2015, “Cyclist safety flagged in new message for motorists”

o Herald Sun, March 24, 2015, “Extend the Cranbourne train line, with plenty of parking and bus support, Monash expert says”.

o The Guardian, October 10, 2014, “Bike accidents mapped five years of cycling crashes in Melbourne”.

o Herald Sun, October 9, 2014, “Cyclists want chunk of Chapel St to be a bike-only zone”

o The Age, July 11, 2014, “Melbourne language study reveals a cacophony of diversity”

Editorial and Referee Activities:

I am on editorial board of the Transportation Letters published by Taylor and Francis. In 2019, I have been a guest editor in Transportation Research Part C for a special issue on “Emerging Methods for Data-driven Urban Transportation and Mobility Modeling: Machine Learning and Complexity Approaches”. In the same year, I have also been a guest editor in Transportation Letters for a special issue on “Emerging Mobility Services”. I am also a frequently invited reviewer for many high-quality journals including Nature Communications, Scientific Reports, Transportation Research Part B, Transportation Research Part C, Transportation Research Part A, Journal of Transport Geography, Transportation Research Record and many others.

Conference organising/scientific committee activities:

o Program and Local Organising Committee, 10th Pedestrian and Evacuation Dynamics Conference (PED2020), 28-20 September 2020, Melbourne, Australia.

o Program Committee, 2020 ITS Asia Pacific Forum, 25-28 May 2020, Brisbane, Australia.

o Theme Leader, 2017 World Symposium on Transport & Land Use Research, 3-6 July 2017, Brisbane, Australia.

o Program Committee, ITS World Congress, 10-14 October 2016, Melbourne, Australia.

o Host/ Local Organising and Scientific Committee, Symposium on Innovations in Traffic Flow Theory and Characteristics (TFT2016), 2-3 July 2016, Sydney.

o Scientific Committee, 1st Symposium on Management of Future Motorway and Urban Traffic Systems (MFTS2016), June 2-3, 2016, Greece.

o Scientific Committee, Traffic and Granular Flow 2015, 27-30 October 2015, Delft, Netherlands.

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

Number of refereed journal publications (Scopus): 43
Number of refereed conference publications (Scopus): 10
Number of citations (Scopus): 653
H-index (Scopus): 15

Number of citations (Google Scholar): 1,189
H-index (Google Scholar): 19

Top journals in the field that I have been successful in publishing papers in:
Proceedings of the National Academic of Science (PNAS) (IF 9.580), 1 paper
Scientific Reports (by Nature) (IF 4.122), 1 paper
Transportation Research Part B (IF 4.574), 2 papers
Transportation Research Part C (IF 5.775), 5 papers
Networks and Spatial Economics (IF 2.695), 1 paper
Analytic Methods in Accident Research (IF 9.333), 1 paper
Accident Analysis & Prevention (IF 3.058), 1 paper
Journal of Transport Geography (IF 3.560), 3 papers

My main publications focus on two research areas of traffic flow theory and transport network modelling.

About 30% of my publications are in Transportation Research Record (TRR), mostly co-authored with Prof. Hani Mahmassani who was my supervisor during my PhD and a former chair and member of the traffic flow theory and characteristics committee and the transportation network modeling committee of the Transportation Research Board of the U.S. National Academies, and a strong advocate of publishing in TRR. After finishing my PhD and starting my independent academic career in Australia, I have been diversifying my publications. As a result, I now have a growing number of papers in other journals including Proceedings of the National Academy of Science (PNAS), Scientific Reports, Transportation Research Part B, Transportation Research Part C, and others as listed above. I also have two papers presented and published as part of the International Symposium on Transportation and Traffic Theory (ISTTT20 and ISTTT22), which is a highly competitive proceedings to publish in with only 10% acceptance rate.

I have more than 30 journal publications with a focus on network traffic flow theory and modelling. As a result, I have attracted international recognition because of my contributions to the network traffic flow theory and understanding the properties of MFD in large-scale networks. My 2013 publication with Prof Hani Mahmassani and Dr Ali Zockaie in Transportation Research Part C on urban network gridlock theory has been recognised as one the most cited papers in the journal since 2013. The main contributions of my network traffic flow theory related publications are exploring the characteristics and dynamics of traffic flow in large-scale networks in the context of Macroscopic Fundamental Diagram (MFD) using both empirical data and simulation-based Dynamic Traffic Assignment (DTA) model. Moreover, from 2014 to 2018, I have been extensively working on developing and calibrating a large-scale simulation-based DTA model of Melbourne and implementation of various congestion pricing mechanisms. Since 2018, I have been extending my network modelling research to applications in congestion pricing, pedestrian/sidewalk networks and exploring alternative methods for macroscopic modelling of network traffic.

In an ongoing collaboration with Associate Prof Nikolas Geroliminis at EPFL, we have been looking into network partitioning and network travel time reliability measurement which has led to a recently accepted publication in Transportation Research Part C.

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-

best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Olmos, L.E., Çolak, S., Shafiei, S., Saberi, M. & González, M.C. 2018, 'Macroscopic dynamics and the collapse of urban traffic', *Proceedings of the National Academy of Sciences of the United States of America*, vol. 115, no. 50, pp. 12654-12661, doi:10.1073/pnas.1800474115 (Refereed Journal Article)

[2] * Hamedmoghadam, H., Ramezani, M. & Saberi, M. 2019, 'Revealing latent characteristics of mobility networks with coarse-graining', *Scientific Reports*, vol. 9, no. 1, doi:10.1038/s41598-019-44005-9 (Refereed Journal Article)

[3] Mahmassani, H.S., Saberi, M. & Zockaie, A. 2013, 'Urban network gridlock: Theory, characteristics, and dynamics', *Transportation Research Part C: Emerging Technologies*, vol. 36, pp. 480-497, doi:10.1016/j.trc.2013.07.002 (Refereed Journal Article)

[4] * Amoh-Gyimah, R., Saberi, M. & Sarvi, M. 2016, 'Macroscopic modeling of pedestrian and bicycle crashes: A cross-comparison of estimation methods', *Accident Analysis and Prevention*, vol. 93, pp. 147-159, doi:10.1016/j.aap.2016.05.001 (Refereed Journal Article)

[5] * Mohajerpoor, R., Saberi, M., Vu, H.L., Garoni, T.M. & Ramezani, M. 2019, 'H <inf>∞</inf> robust perimeter flow control in urban networks with partial information feedback', *Transportation Research Part B: Methodological*, doi:10.1016/j.trb.2019.03.010 (Refereed Journal Article)

[6] * Zockaie, A., Saberi, M. & Saedi, R. 2018, 'A resource allocation problem to estimate network fundamental diagram in heterogeneous networks: Optimal locating of fixed measurement points and sampling of probe trajectories', *Transportation Research Part C: Emerging Technologies*, vol. 86, pp. 245-262, doi:10.1016/j.trc.2017.11.017 (Refereed Journal Article)

[7] * Gu, Z. & Saberi, M. 2019, 'A bi-partitioning approach to congestion pattern recognition in a congested monocentric city', *Transportation Research Part C: Emerging Technologies*, vol. 109, pp. 305-320, doi:10.1016/j.trc.2019.10.016 (Refereed Journal Article)

[8] * Gu, Z., Saberi, M., Sarvi, M. & Liu, Z. 2018, 'A big data approach for clustering and calibration of link fundamental diagrams for large-scale network simulation applications', *Transportation Research Part C: Emerging Technologies*, vol. 94, pp. 151-171, doi:10.1016/j.trc.2017.08.012 (Refereed Journal Article)

[9] Gu, Z., Shafiei, S., Liu, Z. & Saberi, M. 2018, 'Optimal distance- and time-dependent area-based pricing with the Network Fundamental Diagram', *Transportation Research Part C: Emerging Technologies*, vol. 95, pp. 1-28, doi:10.1016/j.trc.2018.07.004 (Refereed Journal Article)

[10] Mohajerpoor, R., Saberi, M. & Ramezani, M. 2019, 'Analytical derivation of the optimal traffic signal timing: Minimizing delay variability and spillback probability for undersaturated intersections', *Transportation Research Part B: Methodological*, vol. 119, pp. 45-68, doi:10.1016/j.trb.2018.11.004 (Refereed Journal Article)

Refereed Journal Articles

[1] Giummarra, M.J., Amoh-Gyimah, R., Saberi, M. & Gabbe, B.J. 2019, 'Geographic variations in reported and treated pain and mental health problems in the first two years after transport-related major trauma', *Journal of Transport and Health*, vol. 14, doi:10.1016/j.jth.2019.100581

[2] Gu, Z., Waller, S.T. & Saberi, M. 2019, 'Surrogate-based toll optimization in a large-scale heterogeneously congested network', *Computer-Aided Civil and Infrastructure Engineering*, vol. 34, no. 8, pp. 638-653, doi:10.1111/mice.12444

[3] Kavianipour, M., Saedi, R., Zockaie, A. & Saberi, M. 2019, 'Traffic State Estimation in Heterogeneous Networks with Stochastic Demand and Supply: Mixed Lagrangian–Eulerian Approach', *Transportation Research Record*, doi:10.1177/0361198119850472

[4] Taherifar, N., Hamedmoghadam, H., Sree, S. & Saberi, M. 2019, 'A macroscopic approach for calibration and validation of a modified social force model for bidirectional pedestrian streams', *Transportmetrica A: Transport Science*, vol. 15, no. 2, pp. 1637-1661, doi:10.1080/23249935.2019.1636156

[5] Ghasri, M., Rashidi, T.H. & Saberi, M. 2018, 'Comparing Survival Analysis and Discrete Choice Specifications Simulating Dynamics of Vehicle Ownership', *Transportation Research Record*, vol. 2672, no. 49, pp. 34-45, doi:10.1177/0361198118791911

[6] Gu, Z., Liu, Z., Cheng, Q. & Saberi, M. 2018, 'Congestion pricing practices and public acceptance: A review of evidence', *Case Studies on Transport Policy*, vol. 6, no. 1, pp. 94-101, doi:10.1016/j.cstp.2018.01.004

[7] * Saberi, M., Rashidi, T.H., Ghasri, M. & Ewe, K. 2018, 'A Complex Network Methodology for Travel Demand Model Evaluation and Validation', *Networks and Spatial Economics*, vol. 18, no. 4, pp. 1051-1073, doi:10.1007/s11067-018-9397-y

[8] * Saberi, M., Ghamami, M., Gu, Y., Shojaei, M.H.S. & Fishman, E. 2018, 'Understanding the impacts of a public transit disruption on bicycle sharing mobility patterns: A case of Tube strike in London', *Journal of Transport Geography*, vol. 66, pp. 154-

166, doi:10.1016/j.jtrangeo.2017.11.018

[9] * Shafiei, S., Gu, Z. & Saberi, M. 2018, 'Calibration and validation of a simulation-based dynamic traffic assignment model for a large-scale congested network', *Simulation Modelling Practice and Theory*, vol. 86, pp. 169-186, doi:10.1016/j.simpat.2018.04.006

[10] Shahhoseini, Z., Sarvi, M. & Saberi, M. 2018, 'Pedestrian crowd dynamics in merging sections: Revisiting the "faster-is-slower" phenomenon', *Physica A: Statistical Mechanics and its Applications*, vol. 491, pp. 101-111, doi:10.1016/j.physa.2017.09.003

[11] * Amoh-Gyimah, R., Saberi, M. & Sarvi, M. 2017, 'The effect of variations in spatial units on unobserved heterogeneity in macroscopic crash models', *Analytic Methods in Accident Research*, vol. 13, pp. 28-51, doi:10.1016/j.amar.2016.11.001

[12] Hamedmoghadam-Rafati, H., Steponavice, I., Ramezani, M. & Saberi, M. 2017, 'A Complex Network Analysis of Macroscopic Structure of Taxi Trips', *IFAC-PapersOnLine*, vol. 50, no. 1, pp. 9432-9437, doi:10.1016/j.ifacol.2017.08.1462

[13] Mohajerpoor, R., Saberi, M. & Ramezani, M. 2017, 'Delay Variability Optimization Using Shockwave Theory at an Undersaturated Intersection', *IFAC-PapersOnLine*, vol. 50, no. 1, pp. 5289-5294, doi:10.1016/j.ifacol.2017.08.622

[14] Saberi, M., Wu, H., Amoh-Gyimah, R., Smith, J. & Arunachalam, D. 2017, 'Measuring housing and transportation affordability: A case study of Melbourne, Australia', *Journal of Transport Geography*, vol. 65, pp. 134-146, doi:10.1016/j.jtrangeo.2017.10.007

[15] * Saberi, M., Mahmassani, H.S., Brockmann, D. & Hosseini, A. 2017, 'A complex network perspective for characterizing urban travel demand patterns: graph theoretical analysis of large-scale origin–destination demand networks', *Transportation*, vol. 44, no. 6, pp. 1383-1402, doi:10.1007/s11116-016-9706-6

[16] * Shafei, S., Saberi, M., Zockaie, A. & Sarvi, M. 2017, 'Sensitivity-based linear approximation method to estimate time-dependent origin-destination demand in congested networks', *Transportation Research Record*, vol. 2669, pp. 72-79, doi:10.3141/2669-08

[17] Shahhoseini, Z., Sarvi, M., Saberi, M. & Haghani, M. 2017, 'Pedestrian crowd dynamics observed at merging sections: Impact of designs on movement efficiency', *Transportation Research Record*, vol. 2622, no. 1, pp. 48-57, doi:10.3141/2622-05

[18] Shahhoseini, Z., Sarvi, M. & Saberi, M. 2016, 'Insights toward characteristics of merging streams of pedestrian crowds based on experiments with panicked ants', *Transportation Research Record*, vol. 2561, pp. 81-88, doi:10.3141/2561-10

[19] Halat, H., Saberi, M., Frei, C.A., Frei, A.R. & Mahmassani, H.S. 2015, 'Impact of crime statistics on travel mode choice: Case Study of the city of Chicago, Illinois', *Transportation Research Record*, vol. 2537, pp. 81-87, doi:10.3141/2537-09

[20] Saberi, M., Aghabayk, K. & Sobhani, A. 2015, 'Spatial fluctuations of pedestrian velocities in bidirectional streams: Exploring the effects of self-organization', *Physica A: Statistical Mechanics and its Applications*, vol. 434, pp. 120-128, doi:10.1016/j.physa.2015.04.008

[21] * Zockaie, A., Saberi, M., Mahmassani, H.S., Jiang, L., Frei, A. & Hou, T. 2015, 'Activity-based model with dynamic traffic assignment and consideration of heterogeneous user preferences and reliability valuation: Application to toll revenue forecasting in Chicago, Illinois', *Transportation Research Record*, vol. 2493, pp. 78-87, doi:10.3141/2493-09

[22] Saberi, M. & Mahmassani, H. 2014, 'Exploring Areawide Dynamics of Pedestrian Crowds: Three-Dimensional Approach', *Transportation Research Record*, vol. 2421, no. 1, doi:10.3141/2421-04

[23] Saberi, M., Mahmassani, H.S., Hou, T. & Zockaie, A. 2014, 'Estimating network fundamental diagram using three-dimensional vehicle trajectories: Extending edie's definitions of traffic flow variables to networks', *Transportation Research Record*, vol. 2422, pp. 12-20, doi:10.3141/2422-02

[24] Saberi, M., Mahmassani, H.S. & Zockaie, A. 2014, 'Network capacity, traffic instability, and adaptive driving: findings from simulated urban network experiments', *EURO Journal on Transportation and Logistics*, vol. 3, no. 3-4, pp. 289-308, doi:10.1007/s13676-013-0040-2

[25] Zockaie, A., Mahmassani, H., Saberi, M. & Verbas, Ö. 2014, 'Dynamics of urban network traffic flow during a large-scale evacuation', *Transportation Research Record*, vol. 2422, no. 1

[26] Kim, J., Mahmassani, H., Alfelor, R., Chen, Y., Hou, T., Jiang, L., Saberi, M., Verbas, O. & Zockaie, A. 2013, 'Implementation and evaluation of weather-responsive traffic management strategies', *Transportation Research Record*, pp. 93-106, doi:10.3141/2396-11

[27] Mahmassani, H., Hou, T. & Saberi, M. 2013, 'Connecting networkwide travel time reliability and the network fundamental diagram of traffic flow', *Transportation Research Record*, pp. 80-91, doi:10.3141/2391-08

[28] Saberi, M. & Mahmassani, H. 2013, 'Hysteresis and capacity drop phenomena in freeway networks: Empirical characterization and interpretation', *Transportation Research Record*, pp. 44-55, doi:10.3141/2391-05

[29] Saberi, M. & Mahmassani, H.S. 2013, 'Modeling the airline hub location and optimal market problems with continuous approximation techniques', *Journal of Transport Geography*, vol. 30, pp. 68-76, doi:10.1016/j.jtrangeo.2013.01.009

[30] Saberi, M., Ali Zockaie, K., Feng, W. & El-Geneidy, A. 2013, 'Definition and properties of alternative bus service reliability measures at the stop level', *Journal of Public Transportation*, vol. 16, no. 1, pp. 97-122, doi:10.5038/2375-0901.16.1.6

[31] Saberi, M. & Verbas, I.O. 2012, 'Continuous approximation model for the vehicle routing problem for emissions minimization at the strategic level', *Journal of Transportation Engineering*, vol. 138, no. 11, pp. 1368-1376, doi:10.1061/(ASCE)TE.1943-5436.0000442

[32] Saberi, M. & Mahmassani, H. 2012, 'Exploring properties of networkwide flow-density relations in a freeway network', *Transportation Research Record*, pp. 153-163, doi:10.3141/2315-16

Fully Refereed Conference Proceedings

[1] Gu, Z. & Saberi, M. 2019, 'A Simulation-Based Optimization Framework for Urban Congestion Pricing Considering Travelers' Departure Time Rescheduling', *2019 IEEE Intelligent Transportation Systems Conference, ITSC 2019*, pp. 2557-2562, doi:10.1109/ITSC.2019.8916910

[2] Ranaweera, M., Seneviratne, A., Rey, D., Saberi, M. & Dixit, V.V. 2019, 'Anomalous data detection in vehicular networks using traffic flow theory', *IEEE Vehicular Technology Conference*, vol. 2019, doi:10.1109/VTCFall.2019.8891471

[3] * Shafiei, S., Saberi, M. & Vu, H.L. 2019, 'Nonlinearity in Time-Dependent Origin-Destination Demand Estimation in Congested Networks', *2019 IEEE Intelligent Transportation Systems Conference, ITSC 2019*, pp. 3892-3897, doi:10.1109/ITSC.2019.8917357

[4] Grace, R. & Saberi, M. 2018, 'The value of accessibility in residential property', *ATRF 2018 - Australasian Transport Research Forum 2018, Proceedings*

[5] * Gu, Z., Saberi, M., Sarvi, M. & Liu, Z. 2017, 'A Big Data Approach for Clustering and Calibration of Link Fundamental Diagrams for Large-Scale Network Simulation Applications', *Transportation Research Procedia*, vol. 23, pp. 901-921, doi:10.1016/j.trpro.2017.05.050

[6] Bagloee, S.A., Sarvi, M., Rajabifard, A., Thompson, R.G. & Saberi, M. 2016, 'A solution to the road network design problem for multimodal flow', *IEEE Conference on Intelligent Transportation Systems, Proceedings, ITSC*, pp. 235-240, doi:10.1109/ITSC.2016.7795560

[7] Gu, Z., Saberi, M., Sarvi, M. & Liu, Z. 2016, 'Calibration of traffic flow fundamental diagrams for network simulation applications: A two-stage clustering approach', *IEEE Conference on Intelligent Transportation Systems, Proceedings, ITSC*, pp. 1348-1353, doi:10.1109/ITSC.2016.7795732

[8] * Shafiei, S., Saberi, M. & Sarvi, M. 2016, 'Application of an exact gradient method to estimate dynamic origin-destination demand for melbourne network', *IEEE Conference on Intelligent Transportation Systems, Proceedings, ITSC*, pp. 1945-1950, doi:10.1109/ITSC.2016.7795870

[9] Meead, S.K. & Bertini, R.L. 2009, 'Toward implementing weather-responsive advanced traffic management and information systems', *16th ITS World Congress*

[10] Saberi Kalaee, M., Rezaeian, M.R., Ahadi, M.R. & Shafabakhsh, G.A. 2009, 'Evaluating the factors affecting student travel mode choice', *50th Annual Transportation Research Forum 2009*, vol. 1, pp. 340-358

F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

No

Part F - Participant Details including ROPE (Dr Simone Zarpelon Leao)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Chief Investigator

Title

Dr

First Name

Simone

Second Name

Family Name

Zarpelon Leao

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
30/01/2003	Doctoral Degree	Doctor of Philosophy	Geomatic Engineering	The University of Melbourne	Australia
30/05/1997	Masters Degree	Master of Urban and Regional Planning	Urban Planning	Universidade Federal do Rio Grande do Sul	Brazil
23/01/1993	Bachelor Degree	Bachelor of Engineering	Environmental Enginnering	Pontificia Universidade Catolica do Rio Grande do Sul	Brazil

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

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F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area**	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
Leao S Z, Lee B, Pettit C *Analytics and visualisation of the integration of active and public transport* Penrith City Council NSW 2020	Y	C		40						
Lee B, **Leao S Z**, Gudes O, Roy S, *Modelling women safety factors on the streets of Manipal, India* MAHE Seed Fund 2020	N	C	N/A	20						
Simone Z Leao, Deepika Shetty, *Assessing land/property value uplift and value capture mechanisms to finance India's new sustainable urban transport infrastructure.* SPARC Program, India Gov. 2019-2021	Y	R	N/A	100	100					

Brian Lee, **Simone Z Leao**, Scott Hawken, Ori Gudes, Sandeep Kumar, Abhinanda Chatterjee. *Improving Women's Safety in Public Spaces.* MAHE-UNSW fund round 1. 2019-2020	Yes	C	N/A	20						

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.2

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of New South Wales	Yes	Employee	1.0

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

The University of New South Wales

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

Yes

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should this application be successful the participant will exceed ARC project limits and must meet the project limits under the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

No PDF file uploaded.

F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Senior Lecturer, Associate Dean International	City Futures Research Centre, Faculty of Built Environment	Permanent	Full Time	02/07/2018		The University of New South Wales

Senior Research Fellow	City Futures Research Centre	Contract	Full Time	02/11/2015	01/07/2018	The University of New South Wales
Senior Lecturer	Faculty of Built Environment	Permanent	Full Time	01/10/2014	01/10/2015	University of Salford
Lecturer	School of Architecture and Built Environment	Permanent	Full Time	01/04/2010	01/10/2014	Deakin University

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

No

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

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F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

Dr Leao graduated 17 years ago with a PhD in Geomatic Engineering from the University of Melbourne. She has experienced 0.0 FTE periods of unemployment or interruptions to her career during this time.

Research Opportunities

From 2004-2006 I held a Post-Doc position at the Faculty of Architecture and Urban Planning at the Federal University of Rio Grande do Sul, Brazil. During this time, I established the new Spatial Planning Group of the Faculty, with teaching and research outputs.

From 2007-2009, at the same university in Brazil, I joined the SIMLAB (Laboratory for Simulation and Modelling in Architecture) as a Research Fellow. During this time, I attracted equivalent to AUD 200,000 in tender funds, and led research-based Master Plans in four metropolitan cities using spatial analysis and urban modelling techniques, managing a team of 10 professionals.

From 2010-2014 I was a Lecturer in Urban Technologies at the School of Architecture and Built Environment at Deakin University, Victoria, Australia. At Deakin I held a teaching and research position with a workload of 40:40:20 in research, teaching and administration (R:T:A), respectively. I chaired and taught the courses of Urban Ecology, Research Methods, and Master Thesis, supervised PhD and Master students, attracted approximately AU$100,000 in funds from local government and industry, developed research, and published 17 papers in peer-reviewed journals and conferences. In 2014 I held the leadership role as PostGraduate Coordinator of the School.

In 2015, I worked as a Senior Lecturer in the Faculty of Architecture and Built Environment at Salford University, UK, with the intention to have professional experience in UK/Europe and develop my academic administrative skills. During this time I hold a teaching and administration position, with a 20:30:50 workload in research, teaching, and administration (R:T:A), respectively. The high administration component was associated with my role in the Faculty as part of the team responsible for designing and getting professional accreditation for the new Master Course in Architecture and Urban Planning; moreover, I held the position of Post-Graduate Coordinator for the Faculty with more than 200 PhD students. In the UK I taught the courses Multi-disciplinary Urban Project and Research Methodology.

From late 2015 to 2018 I was a Senior Research Fellow in Urban Modelling and Simulation at the University of New South Wales, as part of the new Data Analytics Group at the City Futures Research Centre (CFRC). This new group had the objective to add expertise and skills in advanced urban informatics and computer modelling and visualisation to the consolidated and influential urban research developed by the CFRC in the previous 15 years. At CFRC, with a workload of 50:25:25 (R:T:A), I have been involved in research that attracted AU$272,000 funds, I led 4 research projects, published 13 articles (4 book chapters, 5 journal papers, and 4 peer-reviewed conference papers). I was responsible for the production of high-quality visualisations of project outputs displayed in the CityViz weblink at the City Futures website. I have also had a significant input in the design and documentation of the new Master course in City Analytics started from 2018. In teaching I have collaborated with the courses on GIS and Digital Cities.

2018 onwards: From 2018 to the present I moved to a permanent position as a Senior Lecturer at the University of New South Wales with a workload of 40:20:40 (R:T:A), with the same group in City Analytics at the City Futures Research Centre. From 2019 I have been appointed a PLuS Alliance fellow, which is a prestigious funded fellowship between UNSW/Australia, Kings College London/UK, and Arizona State University/USA. From 2019 I have also been appointed the Associate Dean International for the Faculty of Built Environment, being responsible for the leadership on the international profile and outreach of the Faculty. Since 2018, I have attracted $570,000 in research funds, and published high impact 9 articles and book chapters, with additional 3 articles currently under review. Research grant proposals with the India Government, Asian Development Bank, and an ARC Linkage 2020 are currently being prepared. In teaching I am the chair of the courses 'Programmable Cities' and 'Geocomputation', and I collaborate in the courses 'Digital Cities' and 'GIS and urban Informatics'.

Research projects (and funding agencies) developed in the last 4 years include: 3D scenarios of urban renewal (Randwick City Council NSW); Modelling a synthetic population and their demand on social infrastructure (Data Analytics Centre, NSW Government); Travel time catchment areas in Greater Sydney: Opal Card Data Analysis (NSW Department of Planning); Wayfinding at night: international best practice (City of Sydney NSW); Geodesign - Liverpool Collaboration Area (NSW Government, Liverpool City Council); Making Cities Safer For Women and

Children With Smart Technology (DFAT Australia-Korea Council); Growth Infrastructure Compact Pilot Predictive Analytics (NSW Department Planning); Integrated city planning using the RAISE toolkit (CRC for Spatial Information Research); Improving Women's Safety in Public Spaces (MAHE Seed Grant India); Accessibility analytics and visualisations of the integration between active and public transport (City of Penrith NSW).

I have been fortunate to receive mentorship from some stemmed colleagues over the years. This include mentoring in the areas of urban planning by Professor Romula Krafta, urban technologies by Professor Hisham Elkadi, urban modelling and visualisation by Emeritus Professor Ian Bishop, and urban policy by Professor Bill Randolph.

Research Achievements and Contributions

Research income and outputs

I have experience at initiating and leading multidisciplinary research teams to targets within budget and timeframe. I have a successful track of research funding from government and industry in Australia and Brazil, with a total of approximately AUD$ 1.1 million). Since Nov 2015, when I joined UNSW, I have been involved in 10 projects funded by varied government agencies and industry ($840,000). One international grant submission is currently under assessment (AUD$ 200,000 with SPARC, India). These projects led to 26 publications in the last 5 years, including 4 book chapters, 12 high impact journal articles, 8 peer-reviewed conference papers, and 2 published reports. 1 book chapters and 2 journal papers are currently under review.

Invited keynote and speaker addresses

I am regularly invited to provide presentations at international and national conferences. Recent keynote presentations include: "The governance challenge for Smart Cities", GRIHA (Green Rating Integrated Habitat Assessment) Summit on Dec 2019, Delhi, India; "Urban Observatories in Australia", UN Habitat Assembly, May 2019, Nairobi, Kenya; "Challenges and trends in Smart Cities", Design Build, May 2018, Sydney, Australia; "Geodesign: Envisioning South-East Sydney in 2050" at the Analytics Community of Practice/Sydney Water, 30 Jan 2017; "The challenge of expanding and building new schools in highly populated areas" at the School Planning, Design & Construction Conference, Sydney 26 Oct 2016.

Other professional activities

- Awarded a PLuS Alliance fellowship 2018-2020 which establishes an international partnership among UNSW, Kings College London/UK, and Arizona State University/USA. This prestigious fellowship enhance opportunities for international collaborative research among leading global universities. Current PLuS Alliance reerach being developed by Dr Leao includes comparative studies in urban mobility between Australia, UK, and USA, and this has been extended to India, through the PLuS Alliance partnership with Pune Smart City Development Corporation as 'Pune Living Laboratory'.
- As a result of her strong international network in research and education, and global profile of her academic career, Dr Leao has been appointed the Associate Dean International of the Faculty of Built Environment UNSW 2019-2022. This is a leadership appointment at a Faculty and university level generally taken by a Professorial position holder. In this position, Dr Leao is responsible for the international strategy of education, research and partnerships of the Faculty of Built Environment, in alignment with the overall UNSW international strategy.
- Dr Leao is a regular reviewer for the journals 'Applied Geography', 'Urban Science', 'Population Research'; and member of the Editorial Board of 'IET Smart Cities' journal.
- Article featured at the prestigious 'Science for Environment Policy' Magazine of the European Commission which communicates research outputs with practical applications for planning and policy on urban challenges across Europe. The 2Loud? Project (traffic noise monitoring by community with mobile phones) was featured by invitation.
- Member of the organising committee for several conferences, including 'Research@Locate' conference in Sydney in April 2017; Geo Delft Conference 2018, Delft, Netherlands, Oct 2018; Workshop on agent-based modeling with the GAMA platform June 2020, Toulousse, France. Moreover, Dr Leao has been the UNSW lead manager for the GRIHA (Green Rating Integrated Habitat Assessment) Summit in 2018 and 2019 events in Delhi, India.GRIHA is a major large event in urban sustainability in India, attracting high profile speakers, and more than 1,000 delegates from government and industry.
- Member of the Open Geospatial Consortium since 2018.

- Dr Leao currently supervises 3 PhD candidates in the field of City Analytics covering topics on active transport, urban resilience, and data visualisation. Dr Leao is also a mentor of one PhD candidate awarded the prestigious UNSW Scientia PhD Scholarship, with caters for strategic academic professional development and international outlook.

Research impact and advancement of knowledge

I have expertise at the intersection of urban science, environmental science, social science, geographical information science, data analytics, and computer modelling and visualization. As a result of my unique combination of qualifications, I have been working at the cutting-edge of multidisciplinary urban research, and recognised internationally. I have experience with urban science research and teaching in South America, Africa, Oceania, Asia and Europe.

Since joining UNSW in 2015, I have worked with a number of councils and state government agencies across Australia in supporting them in the formulation of strategic plans. This work is focused on bridging scientific knowledge and practice, by developing new analytics and tools which can assist in the response to existing issues. Examples include the development of a new tool to assess economic feasibility of urban redevelopment in Randwick and visualisation of scenarios in 3D; development of a geodesign planning process to envision future scenarios of urban growth for the city of Liverpool NSW; contribute to the District Plans by developing a '30 min city' analysis of the NSW public transport network; developing a mobile synthetic population with big data in collaboration with the Data Analytics Centre of the NSW government; curating and openly publish an anonymised crowdsourced data on cycling that can assist councils to plan cycling infrastructure; etc.

I have lead several workshops with government and industry partners at the UNSW City Analytics Lab (CAL). CAL, launched in 2018, is a high-technology space designed for collaborative planning assisted by data, models and computational environments. CAL has been having a strong role in promoting more collaboration among urban stakeholders locally, in testing new tools and models, and in bridging science and practice.

In education, I had a major contribution to the planning, design and implementation of the new Master in City Analytics at UNSW, led by Prof Chris Pettit. This degree, launched in 2018, fills a gap in Australia's offerings of innovative courses to upgrade built environment professionals to the new technologies and skills required to plan and manage smart cities. I am the Acting Chair of the program, I teach 'Programmable Cities' and 'Geocomputation' in this degree, I supervise master students, and I contribute to the courses 'Digital Cities' and 'Geodesign'.

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

In this research, CI Leao will assist with handling big data, enhancing its use for better understanding of active mobility, and modelling urban movements. Dr Leao has expertise in big data for transport and mobility research. Beyond her experience with conventional mobility/transport data such as the Census Journey to Work and the Household Travel Survey, Dr Leao expertise which includes extensive work with new and unconventional datasets, such as crowdsourced data from fitness or health/environmental advocacy mobile phone applications, and data from new smart public transport ticketing systems.

Her research has approached challenges in several domains of bicycling data including:
•Building a national-longitudinal geospatial bicycling data collection from crowdsourcing with support of the Australian National Data Services. This work developed innovative procedures for cleaning, anonymising, publishing and visualising a very large crowdsourced dataset on bicycling movement in all Australian capital cities with the goal to creating policy relevant information (Leao et al. 2017b).
•Developing methods to assess bias, validity and geographical representativeness of bicycling crowdsourced data. This work is informing planners about to what extent crowdsourced data can be used for planning purposes, and also providing insights on what is required to improve the quality of crowdsourced data in the future (Leao et al 2019; Lieske, Leao et al 2019).
•Using data-driven approaches to better understand bicyclists' behaviour (Izadpanahi, Leao et al 2017) and applying this understanding as rules in agent-based models for bicycling movement forecasting and scenario building (Leao and Pettit 2017). Moreover, she used microsimulation to evolve a synthetic population and emulate its mobility patterns (Leao et al 2017a).
•Bridging data-driven insights with policy goals. A good example is her work on analysing Greater Sydney's Opal Card data to assess to what extent the '30 min city' policy goal is achievable at main employment centres by public transport (https://cityfutures.be.unsw.edu.au/cityviz/30-min-city/, forthcoming paper at the Computers, Environment and Urban Systems Journal).
•More generically, Dr Leao has been also looking at the broader context of Open Data (Hawken, Leao et al 2020) and crowdsourcing as a relevant data source (Leao and Izadpanahi 2016; Leao et al 2014).

Dr Leao has 545 citations with an h-index of 7 when referencing Google Scholar (sourced January 2020) and 269 citations with an h-index of 5 when referencing Scopus (sourced January 2020).

The articles referenced above (listed in section F19) cover methods to enhance availability of good quality bicycling data, insights on the use of crowdsourced data for planning, as well as the development and test of methodologies for modelling and simulation of spatial and temporal urban mobility processes. Together, these outputs present a consolidated expert base required for this research.

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Simone Z. Leao, Scott N. Lieske & Chris J. Pettit 2017, 'Validating crowdsourced bicycling mobility data for supporting city planning', *Transportation Letters*, vol. 11, no. 9, pp. 486–497, doi:10.1080/19427867.2017.1401198 (Refereed Journal Article)

[2] * Simone Leao, Scott Lieske, Lindsey Conrow, Jonathan Doig, Vandana Mann & Chris Pettit 2017, 'Building a National-Longitudinal Geospatial Bicycling Data Collection from Crowdsourcing', *Urban Science*, vol. 1, no. 3, pp. 23, doi:10.3390/urbansci1030023 (Refereed Journal Article)

[3] * Scott N Lieske, Simone Z Leao, Lindsey Conrow & Chris Pettit 2019, 'Assessing geographical representativeness of crowdsourced urban mobility data: An empirical investigation of Australian bicycling', *Environment and Planning B: Urban Analytics and City Science*, pp. 239980831989433, doi:10.1177/2399808319894334 (Refereed Journal Article)

[4] * Simone Z. Leao & Chris Pettit 2017, 'Mapping Bicycling Patterns with an Agent-Based Model, Census and Crowdsourced Data', *Agent Based Modelling of Urban Systems*, Springer International Publishing, pp. 112–128, doi:10.1007/978-3-319-51957-9_7 (Book Chapter)

[5] * C. J. Pettit, S. N. Lieske & S. Z. Leao 2016, 'BIG BICYCLE DATA PROCESSING: FROM PERSONAL DATA TO URBAN APPLICATIONS', *ISPRS Annals of Photogrammetry, Remote Sensing and Spatial Information Sciences*, III-2, pp. 173–179, doi:10.5194/isprsannals-iii-2-173-2016 (Refereed Journal Article)

[6] * Simone Leao, Kok-Leong Ong & Adam Krezel 2014, '2Loud?: Community mapping of exposure to traffic noise with mobile phones', *Environmental Monitoring and Assessment*, vol. 186, no. 10, pp. 6193–6206, doi:10.1007/s10661-014-3848-9 (Refereed Journal Article)

[7] * Kok-Leong Ong, Daswin De Silva, Yee Ling Boo, Ee Hui Lim, Frank Bodi, Damminda Alahakoon & Simone Leao 2016, 'Big Data Applications in Engineering and Science', *Big Data Concepts, Theories, and Applications*, Springer International Publishing, pp. 315–351, doi:10.1007/978-3-319-27763-9_9 (Book Chapter)

[8] * Simone Z. Leao, Nam Huynh, Alison Taylor, Chris Pettit & Pascal Perez 2017, 'Evolution of a Synthetic Population and Its Daily Mobility Patterns Under Spatial Strategies for Urban Growth', *Lecture Notes in Geoinformation and Cartography*, Springer International Publishing, pp. 399–417, doi:10.1007/978-3-319-57819-4_22 (Book Chapter)

[9] * Simone Leao & Parisa Izadpahani 2016, 'Factors Motivating Citizen Engagement in Mobile Sensing: Insights from a Survey of Non-Participants', *Journal of Urban Technology*, vol. 23, no. 4, pp. 85–103, doi:10.1080/10630732.2016.1175824 (Refereed Journal Article)

[10] * Simone Z. Leao, Laurence Troy, Scott N. Lieske, Bill Randolph & Chris Pettit 2018, 'A GIS based planning support system for assessing financial feasibility of urban redevelopment', *GeoJournal*, vol. 83, no. 6, pp. 1373–1392, doi:10.1007/s10708-017-9843-2 (Refereed Journal Article)

Book Chapters

[1] Scott Hawken, Simone Z. Leao, Ori Gudes, Parisa Izadpanahi, Kalpana Viswanath & Christopher Pettit 2019, 'Safer Cities for Women: Global and Local Innovations with Open Data and Civic Technology', *Open Cities | Open Data*, Springer Singapore, pp. 85–105, doi:10.1007/978-981-13-6605-5_4

[2] Aida E. Afrooz, Russell Lowe, Simone Zarpelon Leao & Chris Pettit 2018, '3D and virtual reality for supporting redevelopment assessment', *Real Estate and GIS*, Routledge, pp. 162–185, doi:10.1201/9781315642789-9

[3] Simone Zarpelon Leao, Benoit Gaudou & Chris Pettit 2018, 'An agent-based model for high-density urban redevelopment under varied market and planning contexts', *Real Estate and GIS*, Routledge, pp. 116–139, doi:10.1201/9781315642789-7

[4] Christopher Pettit & Simone Z Leao 2017, 'Dashboard', *Encyclopedia of Big Data*, Springer International Publishing, pp. 1–6, doi:10.1007/978-3-319-32001-4_295-1

Refereed Journal Articles

[1] Oliver Lock, Tomasz Bednarz, Simone Z. Leao & Christopher Pettit 2019, 'A review and reframing of participatory urban dashboards', *City, Culture and Society*, pp. 100294, doi:10.1016/j.ccs.2019.100294

[2] Christopher J Pettit, Scott Hawken, Carmela Ticzon, Simone Z Leao, Aida E Afrooz, Scott N Lieske, Tess Canfield, Hrishi Ballal & Carl Steinitz 2019, 'Breaking down the silos through geodesign – Envisioning Sydney's urban future', *Environment and Planning B: Urban Analytics and City Science*, vol. 46, no. 8, pp. 1387–1404, doi:10.1177/2399808318812887

[3] Simone Z. Leao 2016, 'Assessing the trade-off between data quality and spatial resolution for the Thornthwaite Moisture Index mapping', *Journal of Spatial Science*, pp. 1–18, doi:10.1080/14498596.2016.1220871

[4] SIMONE LEAO 2014, 'Mapping 100 Years of Thornthwaite Moisture Index: Impact of Climate Change in Victoria, Australia', *Geographical Research*, vol. 52, no. 3, pp. 309–327, doi:10.1111/1745-5871.12072

[5] * S. Leao & W. Zhou 2014, 'Monitoring Exposure to Traffic Noise with Mobile Phones in China: A Review of Context', *International Journal of Information and Computer Science*, vol. 3, no. 0, pp. 52, doi:10.14355/ijics.2014.03.008

[6] Simone Leao 2014, 'Mapping Potential Risk for Housing Damage from Ground Movement Due to Climate Change', *International Journal of Environmental Science and Development*, vol. 5, no. 4, pp. 387–392, doi:10.7763/ijesd.2014.v5.515

[7] Kok-Leong Ong, Simone Leao & Adam Krezel 2014, 'Participatory sensing and education', *International Journal of Pervasive Computing and Communications*, vol. 10, no. 4, pp. 419–441, doi:10.1108/ijpcc-04-2014-0030

[8] Simone Leao & Hisham Elkadi 2011, 'The Use of Public Transport in Coastal Australia: Modes of Travel to Work and Greenhouse Emissions', *Advanced Materials Research*, vol. 347, pp. 4034–4044, doi:10.4028/www.scientific.net/amr.347-353.4034

[9] Simone Leão, Ian Bishop & David Evans 2004, 'Spatial–temporal model for demand and allocation of waste landfills in growing urban regions', *Computers, Environment and Urban Systems*, vol. 28, no. 4, pp. 353–385, doi:10.1016/s0198-9715(03)00043-7

[10] Simone Leao, Ian Bishop & David Evans 2004, 'Simulating Urban Growth in a Developing Nation's Region Using a Cellular Automata-Based Model', *Journal of Urban Planning and Development*, vol. 130, no. 3, pp. 145–158, doi:10.1061/(asce)0733-9488(2004)130:3(145)

[11] Simone Leao, Ian Bishop & David Evans 2001, 'Assessing the demand of solid waste disposal in urban region by urban dynamics modelling in a GIS environment', *Resources, Conservation and Recycling*, vol. 33, no. 4, pp. 289–313, doi:10.1016/s0921-3449(01)00090-8

F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

No

Part F - Participant Details including ROPE (Dr Kerry Nice)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Chief Investigator

Title

Dr

First Name

Kerry

Second Name

Alan

Family Name

Nice

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
17/05/2017	Doctoral Degree	Doctor of Philosophy	Science	Monash University	Australia
13/10/2011	Masters Degree	Master of Enviroment and Sustainability	Geography	Monash University	Australia
31/05/1990	Bachelor Degree	Bachelor degree	English and Film Studies	University of Colorado at Boulder	United States of America

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

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F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area** (Yes/No)	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
CI **Nice**: CRC for Water Sensitive Cities & THUD collaboration research contract 2019	Y	C		137						
R Hunter, L Garcia, F Kee, G Ellis, J Thompson, M Stevenson, **K Nice**, J Wijnands, N Anderson *'A vision of healthy urban design for NCD prevention'* UKRI-NHMRC Built Environment and Prevention Research Scheme 2020-2022	Y	R	1194959	246	227	135				

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.1

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of Melbourne	Yes	Employee	0.5
Monash University	Yes	Employee	0.5

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

The University of Melbourne

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

Yes

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should

this application be successful the participant will exceed ARC project limits and must meet the project limits under the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

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F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Research Fellow	School of Earth Atmosphere and Environment	Contract	Part Time	14/06/2017	31/12/2020	Monash University

Research Fellow	Faculty of Architecture, Building and Planning	Contract	Part Time	14/11/2016	15/11/2020	The University of Melbourne
Research Assistant	School of Earth, Atmosphere and Environment	Contract	Part Time	01/06/2012	01/10/2016	Monash University
PhD Thesis	School of Earth, Atmosphere and Environment	Contract	Full Time	01/04/2012	01/08/2016	Monash University
Practical session teaching/lecturing	School of Earth, Atmosphere and Environment	Contract	Part Time	01/08/2013	01/11/2015	Monash University
Research Assistant	School of Mathematical Science	Contract	Part Time	01/04/2012	01/04/2013	Monash University
Environmental Science Assistant	School of Geography & Environmental Science	Contract	Part Time	01/08/2011	27/04/2012	Monash University

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

No

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

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F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

I was awarded my PhD in science (urban micro-climate modelling) from Monash University in March 2017.

I have been employed by the University of Melbourne as a research fellow since November 2016. I have been an active researcher (at 1.0 FTE) for 3 years without interruption. However, during the first year and last year of the period, this has been split 50/50% between the University of Melbourne and Monash University.

Previous to returning to university to complete my PhD, I had 13 year career as a senior and consulting level software engineer, specialising in designing and building multi-tiered applications in Java J2EE (Java Enterprise Edition).

Research Opportunities

I currently hold two positions. My first position is as a Research Fellow with the Transport, Heath, and Urban Design research hub in the facility of Architecture, Building, and Planning at the University of Melbourne. This involves research in quantifying factors in urban design that impact public health outcomes, especially transportation infrastructure. The core group for this research hub contains four other research fellows and senior research fellows looking at this issue from a number of different angles using a variety of methods including artificial intelligence, big data analysis, agent-based modelling, computer vision techniques as well as more traditional statistical methods. The group is highly collaborative and have published as a group approximately 10-20 papers in the last 2- 3 years.

My second position is a 2 year 0.5 FTE research contract as a Research Fellow and urban climate scientist with Monash University and the CRC for Water Sensitive Cities. This role is split between 20% consulting, 40% research, and 40% tool development. The consulting has included urban heat modelling for state and local government, often joint projects with consulting companies such as GHD. The research portion has largely been devoted to assessments of urban heat outcomes for different urban infill development scenarios. The tool development is devoted to continued development of my micro-climate models VTUF-3D and TARGET and their integration with the CRC's scenario platform.

I am currently supervising two PhD students. One is at Monash University looking at the cooling potential at Adelaide Airport of irrigation of the runway buffer areas. The other at the University of Melbourne is looking at the cooling potential and energy balances of misting systems in outdoor areas. I have also supervised the final capstone research projects for 10 Master of IT students at the University of Melbourne.

I have been fortunate to receive excellent mentoring over my academic career. This includes Prof. Nigel Tapper (PhD supervisor; Monash University and current president of The International Association for Urban Climate), Dr. Andrew Coutts (PhD supervisor, Monash University), and Prof Mark Stevenson (supervisor at University of Melbourne).

Research Achievements and Contributions

Due to the 50/50 split in my employment and funding, my research during this period shows a distinct split between the fields of urban climate and urban heat modelling and that of computer vision/machine learning and urban analytics.

The first year of the University of Melbourne position (I was 0.5 FTE during that period) was mostly devoted to organising and writing a ARC Linkage application, 'A Multi-criteria Design Platform to Facilitate Active School Journeys'. This involved devising the method to build an agent based model to quantify urban factors impacting school children undertaking active commuting (walking and cycling) to school, including topography, street network connectivity, risk, pollution levels, and thermal comfort, planning the budget, and drafting the document. The application was submitted in December 2017.

Also during that period, I designed and performed an urban heat analysis of a number of different green field development scenarios in Sunbury for the CRC, especially considering water sensitive (and climate sensitive) urban design. This resulted in a report for the CRC, "Estimating the economic benefits of Urban Heat Island mitigation – Biophysical Aspects", available on their website. I also used that opportunity to improve the performance and usability of my climate models, as very few models can quantify the human thermal benefits of urban green and blue space, especially accounting for cooling effects of vegetation and water evaporation. Writing this work up as a publication is in progress.

Further expanding on this, a significant amount of my research effort over the past 3 years has been devoted to creating modelling tools for my projects but also making them available for other researchers. For example, the code for my urban micro-climate model VTUF-3D is freely available and is currently being used (and improved) by a number of other urban climate scientists around the world. As a result, even at an early research career stage, this has led to recognition as an expert in vegetation modelling at a micro-climate scale, leading to external funding from the CRC for Water Sensitive Cities to further develop this work and consult with local and state government.

In addition, my software development skills and computer vision techniques knowledge has proved transferable to undertaking research in other areas of urban analytics, leading to new innovations in quantifying health impacts of urban design and transportation infrastructure. This has lead to my role as a key contributor to the Transport, Heath, and Urban Design research hub. This contribution is represented in numerous journal publications and collaborative conference presentations (below).

Grants: In 2016 I was awarded the $10,000 Graham Treloar Early Career Researcher Fellowship/ABP Research ECR Project Grant (The University of Melbourne) for the development of the project "Urban canyon mean radiant temperatures predictions through mining Google Street View imagery and neural network machine learning".

Outputs: I currently have 12 published journal articles in Urban Climate (the leading journal in the urban climate field), Geoscientific Model Development, as well as a number of city science and health and injury journals. Two of these were as lead author. One of these, resulting from the Graham Treloar ECR Fellowship, was an invited submission to a special issue of the Urban Climate journal. I also have a number of arXiv preprints that are in stages of submission and review.

Organisations: I maintain memberships in the European Geosciences Union (EGU), The Australian Meteorological and Oceanographic Society (AMOS), The International Association for Urban Climate (ICUC), and the Complex Systems Society. I have also have long been a member of the London Cycling Campaign (Tower Hamlets Wheelers) in the UK and more recently the Darebin Bike User Group (BUG) in Melbourne.

International collaborations: Over the last few years, I have been collaborating with a number of leading international collaborators. Through my urban climate network, I am currently working with the Urban Climate Research Center at Arizona State University, including Dr. Ariane Middel and Dr. Ashley Broadbent. In public health, I have been collaborating with Dr. James Woodcock and Dr. Rahul Goel from Cambridge University. I have recently started collaborating on a project with leading city scientist Dr. Marc Barthelemy from the Institut de Physique Theorique (CEA).

Media outreach:

Nigel Gladstone, 7 May 2018, Sydney Morning Herald, "10 places in Sydney that look like Paris. They're not where you might think." Article

Referee Activities: In the past 3 years, I have performed 19 peer reviews for 8 leading climate and urban journals, including Urban Climate, Theoretical and Applied Climatology, Sustainable Cities and Society, and Building Simulation.

Conference Presentations / Guest lectures:

The Nature of Human Settlement: Building an understanding of high performance city design (a.k.a. Block Typologies). In: UrbanSys2019 satellite session of 2019 Conference on Complex Systems, Singapore, 2 October 2019. Presentation

Urban climatology introduction for Melbourne Cool Line Studio, Monash University, 19 August 2019. Guest lecture

Climate science context around urban cooling. In: 4th Water Sensitive Cities Conference 2019, 26 - 28 March 2019, Brisbane, Australia. Invited presentation

Mining Google Street View for Urban Climate Micro-Climate Human Thermal Comfort Modelling Parameters. In: ICUC10, 10th International Conference on Urban Climate/ 14th Symposium on the Urban Environment, 6-10 August 2018, New York, NY. Presentation

The ‘Paris-end’ of town? Urban typology through machine learning. In: AAG 2018, Symposium on New Horizons in Human Dynamics Research, New Orleans, 12 April 2018. Presentation

Urban Greening for improved human thermal comfort. In: 202020 Vision, The Green Light Tour, 27 March 2018, Adelaide, Australia. Invited presentation

Urban Greening for improved human thermal comfort. In: Guest lecture - Master of urban planning STUDIO, University of Melbourne, 2 October 2017, Melbourne, Australia.

Microclimate Models and Application in the Urban Environment. In: Guest lecture - ATS3887/APG4887 - Designing Urban Futures: Urban Climate, Water and Adaptation. Monash University. September 2017 - Melbourne, Australia.

Designing liveable cities through heat mitigation: tools to translate knowledge into design. In: 3rd Water Sensitive Cities Conference, 18-20 July 2017, Perth. Invited presentation Urban Greening for improved human thermal comfort. In: CRC for Water Sensitive Cities Ideas for Subiaco Water Resource Area, 24 May 2017, Perth. Invited presentation

A micro-climate examination of the temperature moderating potential of increased vegetation and water in urban canyons using VTUF-3D. In: 29th VUEESC Conference, 3-4 November 2016, Melbourne. Presentation

Microclimate Models and Application in the Urban Environment. In: Guest lecture - ATS3887/APG4887 - Designing Urban Futures: Urban Climate, Water and Adaptation. Monash University. September 2016 - Melbourne, Australia.

A micro-climate examination of the temperature moderating potential of increased vegetation and water in urban canyons using VTUF-3D. In: Joint CRC Low Carbon Living & CRC for Water

Sensitive Cities Workshop on Urban Micro-Climates and Adaptive Urban Design, 21-22 March 2016, Melbourne. Presentation

A micro-climate examination of the temperature moderating potential of increased vegetation and water in urban canyons using VTUF-3D. In: 2nd International Conference on Urban Tree Diversity, 22-24 February 2016, Melbourne. Presentation

A micro-climate examination of the temperature moderating potential of increased vegetation and water in urban canyons using VTUF-3D. In: AMOS/ARCCSS National Conference 2016. 8-11 February 2016, Melbourne Convention and Exhibition Centre. Presentation

Microclimate Models and Application in the Urban Environment. In: Guest lecture - ATS3887/APG4887 - Designing Urban Futures: Urban Climate, Water and Adaptation. Monash University. 16 September 2015 - Melbourne, Australia. Presentation

VTUF-3D: An urban micro-climate model to assess temperature moderation from increased vegetation and water in urban canyons. In: 2nd Water Sensitive Cities Conference 2015. 8-9 September 2015 - Brisbane, Australia. Poster 1 Poster 2 Presentation

VTUF-3D: An urban micro-climate model to assess temperature moderation from increased vegetation and water in urban canyons. In: ICUC9 - 9th International Conference on Urban Climate 2015. 20-24 July 2015 - Toulouse, France. Presentation

Introducing the TUF-3D/MAESPA urban micro-climate model. In: 8th International Water Sensitive Urban Design Conference 2013. 25–29 November 2013 - Gold Coast, Australia. Presentation

Evaluation of WSUD modeling strategies. In: 8th International Conference on Urban Climate – ICUC 8 and 10th Symposium on the Urban Environment. 6th - 10th August 2012 - Dublin, Ireland. Presentation

The micro-climate of a mixed urban parkland environment [online]. In: WSUD 2012: Water sensitive urban design; Building the water sensitive community; 7th International Conference on Water Sensitive Urban Design, 21 - 23 February 2012, Melbourne Cricket Ground. Barton, A.C.T.: Engineers Australia, 2012: 719-739. ISBN: 9780858258952. Presentation

Collaborative presentations:

'Road Traffic Injury in Urban Areas: Understanding the Complex City', in ICoRSI International Symposium on Safety of Vulnerable Road Users, 25-26 March 2019, Changsha, China, pp. 25–26.

'A new Urban Ecohydrological Model to quantify the effect of vegetation on microclimate and water fluxes in cities', In: AGU Fall Meeting 2018, Washington D.C., USA, 10-14 December 2018. American Geophysical Union (AGU Fall Meeting Abstracts), p. GC33C–06. Presentation

"Action recognition to prevent fatigue-related road trauma using artificial intelligence". In: Symposium on New Research Applications for Tackling Complex Road Safety Issues, 2018 Australasian Road Safety Conference. Oct. 3, 2018. Sydney. Invited talk.

"Using GANs to optimise health outcomes of cities by transforming urban design". In: 4th International Conference on Machine Vision and Machine Learning. Aug. 21–23, 2018. Madrid.

"Using deep learning to detect driver drowsiness from video footage". In: International Conference on Engineering, Technology, and Applied Science. Nov. 7–9, 2017. Kitakyushu.

Summary: As an early-career researcher, I have quickly built a large body of work, put together a strong collaborative network (both within my universities and internationally), and developed a strong research direction based on modelling and quantifying urban systems. This rapid upward trajectory has been strongly enabled by a previous long career in industry and software engineering that required the ability to develop and organise large projects, solve problems, and build the tools necessary to deliver the results. I'm excited to be included in this project and provide necessary and missing information about cycling infrastructure and risk exposure to help encourage more cycling and make my own cycling safer and more pleasant.

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

My research career has evolved from my previous career in industry, 13 years as a senior level software engineer. This strong base in software development has allowed me to build numerous models and quantitative platforms to analyse and model urban systems. In my PhD, I developed one of the first models (Publication #5) to examine the cooling benefits of urban vegetation at a micro-climate scale. This work lead to co-development of a number other models (#6 and 10 published in the highly regarded Geoscientific Model Development) to examine similar questions at micro- and local-scales.

My research has also expanded to include the utilisation of computer vision techniques and neural networks to take advantage of large amounts of imagery to study and plan the transformation of urban areas. Publication #2, recently published in The Lancet Planetary Health, used neural networks to cluster the largest 1700 global cities using millions of maps and examine the impact of urban design types on road trauma. This work was further developed for an Asian/Pacific context in #9. In Publication #3 and #8, generative adversarial networks are used to transform street level and satellite imagery from areas with poor outcomes (in terms of cycling safety, obesity, social isolation, and other factors) into new imagery that gives insights into the urban factors leading to these poor outcomes. Finally, in Publication #7, a mobile phone application was developed to detect drowsiness in drivers in real time.

While many of these previous publications demonstrate versatility in utilising imagery and neural networks to provide methods to examine health outcomes influenced by urban design and transportation infrastructure, perhaps Publications #4 and #1 developed methods most relevant to this application. In #4, satellite imagery and neural networks were used to determine transport mode shares across the state of Victoria. More importantly, in #1, many of the same techniques proposed to complete Phase 1 of this project were tested and utilised to develop and improve sky pixel detection in street level imagery.

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Kerry A. Nice, Jasper S. Wijnands, Ariane Middel, Jingcheng Wang, Yiming Qiu, Nan Zhao, Jason Thompson, Gideon D.P.A. Aschwanden, Haifeng Zhao & Mark Stevenson 2020, 'Sky pixel detection in outdoor imagery using an adaptive algorithm and machine learning', *Urban Climate*, vol. 31, pp. 100572, doi:10.1016/j.uclim.2019.100572 (Refereed Journal Article)

[2] * Jason Thompson, Mark Stevenson, Jasper S Wijnands, Kerry A Nice, Gideon DPA Aschwanden, Jeremy Silver, Mark Nieuwenhuijsen, Peter Rayner, Robyn Schofield, Rohit Hariharan & Christopher N Morrison 2020, 'A global analysis of urban design types and road transport injury: an image processing study', *The Lancet Planetary Health*, vol. 4, no. 1, pp. e32–e42, doi:10.1016/s2542-5196(19)30263-3 (Refereed Journal Article)

[3] * Jasper S. Wijnands, Kerry A. Nice, Jason Thompson, Haifeng Zhao & Mark Stevenson 2019, 'Streetscape augmentation using generative adversarial networks: Insights related to health and wellbeing', *Sustainable Cities and Society*, vol. 49, pp. 101602, doi:10.1016/j.scs.2019.101602 (Refereed Journal Article)

[4] * Gideon DPA Aschwanden, Jasper S Wijnands, Jason Thompson, Kerry A Nice, Haifeng Zhao & Mark Stevenson 2019, 'Learning to walk: Modeling transportation mode choice distribution through neural networks', *Environment and Planning B: Urban Analytics and City Science*, pp. 239980831986257, doi:10.1177/2399808319862571 (Refereed Journal Article)

[5] Kerry A. Nice, Andrew M. Coutts & Nigel J. Tapper 2018, 'Development of the VTUF-3D v1.0 urban micro-climate model to support assessment of urban vegetation influences on human thermal comfort', *Urban Climate*, vol. 24, pp. 1052–1076, doi:10.1016/j.uclim.2017.12.008 (Refereed Journal Article)

[6] Ashley M. Broadbent, Andrew M. Coutts, Kerry A. Nice, Matthias Demuzere, E. Scott Krayenhoff, Nigel J. Tapper & Hendrik Wouters 2019, 'The Air-temperature Response to Green/blue-infrastructure Evaluation Tool (TARGET v1.0): an efficient and user-friendly model of city cooling', *Geoscientific Model Development*, vol. 12, no. 2, pp. 785–803, doi:10.5194/gmd-12-785-2019 (Refereed Journal Article)

[7] * Jasper S. Wijnands, Jason Thompson, Kerry A. Nice, Gideon D. P. A. Aschwanden & Mark Stevenson 2019, 'Real-time monitoring of driver drowsiness on mobile platforms using 3D neural networks', *Neural Computing and Applications*, doi:10.1007/s00521-019-04506-0 (Refereed Journal Article)

[8] * Haifeng Zhao, Jasper Wijnands, Kerry Nice, Jason Thompson, Gideon Aschwanden, Jingqiu Guo & Mark Stevenson 2019, 'Reducing Cyclist Crashes by Assessing the Road Environment: An Application of Google Imagery and Machine Learning', *Journal of Transport & Health*, vol. 14, pp. 100698, doi:10.1016/j.jth.2019.100698 (Refereed Journal Article)

[9] * Mark Stevenson, Jason Thompson, Jasper S. Wijnands, Kerry Nice, Gideon Aschwanden & Haifeng Zhao 2019, 'Opportunities to reduce road traffic injury: new insights from the study of urban areas', *International Journal of Injury Control and Safety Promotion*, pp. 1–7, doi:10.1080/17457300.2019.1704790 (Refereed Journal Article)

[10] Naika Meili, Gabriele Manoli, Paolo Burlando, Elie Bou-Zeid, Winston T. L. Chow, Andrew M. Coutts, Edoardo Daly, Kerry A. Nice, Matthias Roth, Nigel J. Tapper, Erik Velasco, Enrique R. Vivoni & Simone Fatichi 2020, 'An urban ecohydrological model to quantify the effect of vegetation on urban climate and hydrology (UT&C v1.0)', *Geoscientific Model Development*, vol. 13, no. 1, pp. 335–362, doi:10.5194/gmd-13-335-2020 (Refereed Journal Article)

Book Chapters

[1] * Haifeng Zhao, Jasper S. Wijnands, Kerry A. Nice, Jason Thompson, Gideon D. P. A. Aschwanden, Mark Stevenson & Jingqiu Guo 2019, 'Unsupervised Deep Learning to Explore Streetscape Factors Associated with Urban Cyclist Safety', *Smart Innovation, Systems and Technologies*, Springer Singapore, pp. 155–164, doi:10.1007/978-981-13-8683-1_16

Refereed Journal Articles

[1] Dietmar Dommenget, Kerry Nice, Tobias Bayr, Dieter Kasang, Christian Stassen & Michael Rezny 2019, 'The Monash Simple Climate Model experiments (MSCM-DB v1.0): an interactive database of mean climate, climate change, and scenario simulations', *Geoscientific Model Development*, vol. 12, no. 6, pp. 2155–2179, doi:10.5194/gmd-12-2155-2019

[2] Naika Meili, Gabriele Manoli, Paolo Burlando, Elie Bou-Zeid, Winston T. L. Chow, Andrew M. Coutts, Edoardo Daly, Kerry A. Nice, Matthias Roth, Nigel J. Tapper, Erik Velasco, Enrique R. Vivoni & Simone Fatichi 2019, 'An urban ecohydrological model to quantify the effect of vegetation on urban climate and hydrology (UT&C v1.0)', doi:10.5194/gmd-2019-225

[3] Kerry Nice 2018, 'Development, validation, and demonstration of the VTUF-3D v1.0 urban micro-climate model to support assessments of urban vegetation influences on human thermal comfort', doi:10.31237/osf.io/d769f

Fully Refereed Conference Proceedings

[1] Nice, K.A. & Isaac, P. 2012, 'The micro-climate of a mixed urban parkland environment', *WSUD 2012 - 7th International Conference on Water Sensitive Urban Design: Building the Water Sensitive Community, Final Program and Abstract Book*

F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

No

Part F - Participant Details including ROPE (Prof Tarek Sayed)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Partner Investigator

Title

Prof

First Name

Tarek

Second Name

Family Name

Sayed

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
01/05/1995	Doctoral Degree	Ph.D.	Civil Engineering (Transportation)	The University of British Columbia	Canada
30/06/1992	Masters Degree	M.A.Sc.	Civil Engineering (Transportation)	The University of British Columbia	Canada
30/06/1988	Bachelor Degree	B.Sc.	Civil Engineering	Ain Shams University	Egypt

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

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F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area** (Yes/No)	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
UBC Department research contribution to Canada Research Chair in Transportation Safety and Advanced Mobility **T Sayed** 2020-2025	N	C		40	40	40	40	40	40	
T Sayed 'Advanced Proactive Road Safety Management Techniques' *Natural Sciences and Engineering Research Council of Canada– Research Grant (Discovery)* 2019-2020	Y	C		60						

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.1

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
The University of British Columbia		Employee	1.0

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

The University of British Columbia

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

No

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should this application be successful the participant will exceed ARC project limits and must meet the project limits under the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Yes

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

No PDF file uploaded.

F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Professor	Civil Engineering	Permanent	Full Time	01/07/2004		The University of British Columbia, Canada

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-

rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

No

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

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F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

Professor Tarek Sayed graduated with a PhD in Civil Engineering / Transportation from the University of British Columbia, Canada, 25 years ago in 1995. Professor Sayed has experienced 0.0 FTE periods of unemployment or interruptions to his career during this time.

Research Opportunities

Tarek Sayed is a distinguished professor and a Tier 1 Canada Research Chair of Transportation Safety and Advanced Mobility at the University of British Columbia. He is also a Fellow of the Engineering Institute of Canada, the Canadian Academy of Engineering, and the Canadian Society for Civil Engineering and was the editor of the Canadian Journal of Civil Engineering for 8 years. He has a distinguished research track record in transportation engineering and has received a high number of honors and awards. In 2004, UBC granted Dr. Sayed the title of Distinguished University Scholar, an honor held by a very small group of professors at UBC.

Research Achievements and Contributions

During his research activities, Dr Sayed has addressed a wide spectrum of transportation system applications with a focus on traffic operation and safety, Intelligent Transportation Systems, and the application of information technologies. He supervised to completion 85 Master and PhD students and he is the author or co-author of more than 350 journal and conference papers, including 200 published in the leading international journals. As well, he has completed numerous consulting projects in traffic operations and safety in North America and internationally, many of these relating directly to his research contributions and findings.

Prizes, honours and awards

Dr. Sayed is the recipient of a number of prestigious awards including the appointment as a UBC Distinguished University Scholar, the ITE Wilbur Smith Distinguished Transportation Educator Award, the Canadian Society of Civil Engineering Sandford Fleming Award, the Transportation Association of Canada Academic Merit Award, the Transportation Association of Canada Gilchrist Medal and several best paper and teaching awards. In 2014, he was awarded the Centennial Road Safety Award from the Transportation Association of Canada. This one time award recognizes his outstanding transformational and long-term contributions to road safety over the past 100 years. And in 2015, Dr. Sayed received the Prince Michael International Road Safety Award for the most outstanding international road safety initiative.

Invited keynote and speaker addresses

Dr Sayed has given over 60 keynote and invited speaker addresses at both local and international conferences. Dr Sayed is also regularly invited to comment on road safety and transportation issues by Canadian media.

Other professional activities and leadership

Dr Sayed served as a chair of both the Transportation and the computer application divisions of the Canadian Society of Civil Engineering. He has instructed and organized many short courses and seminars in traffic safety, operations and ITS for the Institute of Transportation Engineers (ITE), the Insurance Corporation of British Columbia (ICBC), the BC Ministry of Transportation (BCMOT), Ashghal (Qatar), Ministry of Public Works (Kuwait), State Farm Insurance (US), and the US Federal Highway Administration, among others. He also serves on several national and international committees including the US Transportation Research Board safety data and analysis Committee, the US Transportation Research Board future directions for road safety subcommittee, the US Transportation Research Board Pedestrian Committee and the Canadian National Road Safety Committee.

Research impact and advancement of knowledge

Dr. Sayed's research to improve the methods of traffic safety analysis and evaluation is helping to reshape how road safety problems are identified and evaluated. The methods and techniques developed have received wide recognition

and are being used by several agencies such as the Insurance Corporation of British Columbia (ICBC), US State Farm Insurance, US AAA Michigan, and the US Federal Highway Administration (FHWA). Dr. Sayed has completed numerous safety audits in Canada, the US and the Middle East. Improving the understanding and relationship between safety performance and traffic operations/road design is another research interest of Dr. Sayed and responds to the demand for this knowledge among transportation professionals. His research work led to an evaluation framework that was adopted by BCMOT to evaluate the new design of the Sea to Sky Highway, located between Vancouver and Whistler, in southern British Columbia. The highway was rebuilt to meet the demand for the 2010 Winter Olympics with a budget exceeding 1.00 billion dollars. This framework allowed decision makers the opportunity to analyze the safety benefits in relation to the cost of new highway design improvements.

The novel automated road safety analysis techniques developed by Dr Sayed's research group which are based on advanced video analysis technology offer a solution that can change how traffic safety is managed by enabling the detection of collision risk without the need for collisions to occur. Furthermore, this approach should offer a better understanding of collision failure mechanisms, particularly the collision-avoidance behavior of road users which should help our diagnosis of the safety problems and the selection of safety countermeasures. With all recognized limitations to the state-of-practice, many safety practitioners believe that within this research lies the future of road safety analysis. The automated approach has been used in projects in 12 different countries for various safety applications.

Within the area of ITS and traffic operations, I have supervised the completion of many ITS projects as the Director of the Bureau of Intelligent Transportation Systems and Freight Security (BITSAFS-Engineering) at UBC. My research to develop a comprehensive strategy for Transit Signal Priority has been successfully applied on two corridors in Vancouver. Also, on a strategic level, I helped establish a provincial ITS vision and strategic plan for using advanced technologies to help solve provincial, regional and local transportation issues.

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

During his research activities, Professor Tarek Sayed has addressed a wide spectrum of transportation system applications with a focus on traffic operation and safety, Intelligent Transportation Systems, and the application of information technologies. He is the author or co-author of more than 350 journal and conference papers, including 200 published in the leading international journals. These including leading transportation and safety journals, such as Transportation Research Record, Accident Analysis and Prevention, Transportation Research Part C, Sustainability, and IET Intelligent Transport Systems.

The impact of Professor Sayed's research is evidenced by citations:
•Scopus lists 4,384 citations with an h-index of 35 (sourced January 2020)
•Google Scholar lists 8,126 citations with an h-index of 47 (sourced January 2020)

Additionally, he has completed numerous consulting projects in traffic operations and safety in North America and internationally, many of these relating directly to his research contributions and findings.

Professor Sayed has developed world-leading methods for modelling cycling volumes (El Elsawey et al. 2015 and Esawey et al. 2013), spatial analyses of cycling safety (e.g. Osama & Sayed 2017, Osama & Sayed 2016, Osama et al. 2018), the use of machine learning models for traffic volume estimation (Alrukaibi et al. 2019) and is internationally renowned for his computer vision machine learning and conflict analysis research (e.g. Zaki et al. 2013).

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Mohamed El Esawey, Clark Lim & Tarek Sayed 2015, 'Development of a cycling data model: City of Vancouver case study', *Canadian Journal of Civil Engineering*, vol. 42, no. 12, pp. 1000–1010, doi:10.1139/cjce-2015-0065 (Refereed Journal Article)

[2] * Esawey, M.E., Lim, C., Sayed, T. & Mosa, A.I. 2013, 'Development of daily adjustment factors for bicycle traffic', *Journal of Transportation Engineering*, vol. 139, no. 8, pp. 859-871 (Refereed Journal Article)

[3] * Ahmed Osama & Tarek Sayed 2017, 'Investigating the effect of spatial and mode correlations on active transportation safety modeling', *Analytic Methods in Accident Research*, vol. 16, pp. 60–74, doi:10.1016/j.amar.2017.08.003 (Refereed Journal Article)

[4] * Ahmed Osama & Tarek Sayed 2016, 'Evaluating the impact of bike network indicators on cyclist safety using macro-level collision prediction models', *Accident Analysis & Prevention*, vol. 97, pp. 28–37, doi:10.1016/j.aap.2016.08.010 (Refereed Journal Article)

[5] * Fahad Alrukaibi, Rushdi Alsaleh & Tarek Sayed 2019, 'Applying Machine Learning and Statistical Approaches for Travel Time Estimation in Partial Network Coverage', *Sustainability*, vol. 11, no. 14, pp. 3822, doi:10.3390/su11143822 (Refereed Journal Article)

[6] * Mohamed H. Zaki, Tarek Sayed & Andrew Cheung 2013, 'Computer Vision Techniques for the Automated Collection of Cyclist Data', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2387, no. 1, pp. 10–19, doi:10.3141/2387-02 (Refereed Journal Article)

[7] * Ahmed Osama, Tarek Sayed & Emanuele Sacchi 2018, 'A Novel Technique to Identify Hot Zones for Active Commuters' Crashes', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2672, no. 38, pp. 266–276, doi:10.1177/0361198118786829 (Refereed Journal Article)

[8] * El Esawey, M. & Sayed, T. 2011, 'Calibration and validation of micro-simulation models of medium-size networks', *Advances in Transportation Studies*, pp. 57-76 (Refereed Journal Article)

[9] * El Esawey, M. & Sayed, T. 2011, 'Travel time estimation in urban networks using limited probes data', *Canadian Journal of Civil Engineering*, vol. 38, no. 3, pp. 305-318 (Refereed Journal Article)

[10] * Esawey, M.E. & Sayed, T. 2012, 'A framework for neighbour links travel time estimation in an urban network', *Transportation Planning and Technology*, vol. 35, no. 3, pp. 281-301 (Refereed Journal Article)

Refereed Journal Articles

[1] Yanyong Guo, Lai Zheng & Tarek Sayed 2020, 'A comparison of collision-based and conflict-based safety evaluation of left-turn bay extension', *Transportmetrica A: Transport Science*, pp. 1–42, doi:10.1080/23249935.2020.1722286

[2] Mohamed Essa & Tarek Sayed 2019, 'Full Bayesian conflict-based models for real time safety evaluation of signalized intersections', *Accident Analysis & Prevention*, vol. 129, pp. 367–381, doi:10.1016/j.aap.2018.09.017

[3] Yanyong Guo, Tarek Sayed & Mohamed H. Zaki 2019, 'Examining two-wheelers' overtaking behavior and lateral distance choices at a shared roadway facility', *Journal of Transportation Safety & Security*, pp. 1–21, doi:10.1080/19439962.2019.1571549

[4] Lai Zheng & Tarek Sayed 2019, 'From univariate to bivariate extreme value models: Approaches to integrate traffic conflict indicators for crash estimation', *Transportation Research Part C: Emerging Technologies*, vol. 103, pp. 211–225, doi:10.1016/j.trc.2019.04.015

[5] * Mohamed Essa & Tarek Sayed 2018, 'Traffic conflict models to evaluate the safety of signalized intersections at the cycle level', *Transportation Research Part C: Emerging Technologies*, vol. 89, pp. 289–302, doi:10.1016/j.trc.2018.02.014

[6] Yanyong Guo, Tarek Sayed & Mohamed H. Zaki 2018, 'Evaluating the safety impacts of powered two wheelers on a shared roadway in China using automated video analysis', *Journal of Transportation Safety & Security*, vol. 11, no. 4, pp. 414–429, doi:10.1080/19439962.2018.1447058

[7] Mohamed Hussein & Tarek Sayed 2018, 'Validation of an agent-based microscopic pedestrian simulation model in a crowded pedestrian walking environment', *Transportation Planning and Technology*, pp. 1–22, doi:10.1080/03081060.2018.1541279

[8] Lai Zheng, Karim Ismail, Tarek Sayed & Tazeen Fatema 2018, 'Bivariate extreme value modeling for road safety estimation', *Accident Analysis & Prevention*, vol. 120, pp. 83–91, doi:10.1016/j.aap.2018.08.004

[9] Tarek Sayed & Emanuele Sacchi 2016, 'Evaluating the safety impact of increased speed limits on rural highways in British Columbia', *Accident Analysis & Prevention*, vol. 95, pp. 172–177, doi:10.1016/j.aap.2016.07.012

[10] Mohamed Essa & Tarek Sayed 2015, 'Transferability of calibrated microsimulation model parameters for safety assessment using simulated conflicts', *Accident Analysis & Prevention*, vol. 84, pp. 41–53, doi:10.1016/j.aap.2015.08.005

[11] Emanuele Sacchi & Tarek Sayed 2015, 'Investigating the accuracy of Bayesian techniques for before–after safety studies: The case of a "no treatment" evaluation', *Accident Analysis & Prevention*, vol. 78, pp. 138–145, doi:10.1016/j.aap.2015.03.006

[12] Tageldin, A., Sayed, T., Zaki, M.H. & Azab, M. 2014, 'A safety evaluation of an Adaptive Traffic Signal Control system using Computer Vision', *Advances in Transportation Studies*, vol. 2, no. SPECIAL ISSUE, pp. 83-96

[13] Sacchi, E. & Sayed, T. 2014, 'Accounting for heterogeneity among treatment sites and time trends in developing crash modification functions', *Accident Analysis and Prevention*, vol. 72, pp. 116-126

[14] Hediyeh, H., Sayed, T., Zaki, M.H. & Ismail, K. 2014, 'Automated Analysis of Pedestrian Crossing Speed Behavior at Scramble-phase Signalized Intersections Using Computer Vision Techniques', *International Journal of Sustainable Transportation*, vol. 8, no. 5, pp. 382-397

[15] * Sacchi, E., Sayed, T. & El-Basyouny, K. 2014, 'Collision modification functions: Incorporating changes over time', *Accident Analysis and Prevention*, vol. 70, pp. 46-54

[16] * Hediyeh, H., Sayed, T., Zaki, M.H. & Mori, G. 2014, 'Pedestrian gait analysis using automated computer vision techniques', *Transportmetrica A: Transport Science*, vol. 10, no. 3, pp. 214-232

[17] Carlos Llorca, Ana Tsui Moreno, Tarek Sayed & Alfredo García 2014, 'Sight Distance Standards Based on Observational Data Risk Evaluation of Passing', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2404, no. 1, pp. 18–26, doi:10.3141/2404-03

[18] Zaki, M.H. & Sayed, T. 2013, 'A framework for automated road-users classification using movement trajectories', *Transportation Research Part C: Emerging Technologies*, vol. 33, pp. 50-73

[19] * Ismail, K., Sayed, T. & Saunier, N. 2013, 'A methodology for precise camera calibration for data collection applications in urban traffic scenes', *Canadian Journal of Civil Engineering*, vol. 40, no. 1, pp. 57-67

[20] * Sayed, T., Zaki, M.H. & Autey, J. 2013, 'Automated safety diagnosis of vehicle-bicycle interactions using computer vision analysis', *Safety Science*, vol. 59, pp. 163-172

[21] * Zaki, M.H., Sayed, T. & Mori, G. 2013, 'Classifying road users in urban scenes using movement patterns', *Journal of Computing in Civil Engineering*, vol. 27, no. 4, pp. 395-406

[22] El-Basyouny, K. & Sayed, T. 2013, 'Depth-based hotspot identification and multivariate ranking using the full Bayes approach', *Accident Analysis and Prevention*, vol. 50, pp. 1082-1089

[23] Autey, J., Sayed, T. & El Esawey, M. 2013, 'Operational performance comparison of four unconventional intersection designs using micro-simulation', *Journal of Advanced Transportation*, vol. 47, no. 5, pp. 536-552

[24] * Quintero, L., Sayed, T. & Wahba, M.M. 2013, 'Safety models incorporating graph theory based transit indicators', *Accident Analysis and Prevention*, vol. 50, pp. 635-644

[25] El-Basyouny, K. & Sayed, T. 2013, 'Safety performance functions using traffic conflicts', *Safety Science*, vol. 51, no. 1, pp. 160-164

[26] Houman Hediyeh, Tarek Sayed & Mohamed H. Zaki 2013, 'Use of Spatiotemporal Parameters of Gait for Automated Classification of Pedestrian Gender and Age', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2393, no. 1, pp. 31–40, doi:10.3141/2393-04

[27] * M. Ahsanul Karim, Mohamed M. Wahba & Tarek Sayed 2013, 'Spatial Effects on Zone-Level Collision Prediction Models', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2398, no. 1, pp. 50–59, doi:10.3141/2398-06

[28] Simon Chun-Yin Li, Tarek Sayed & Karim El-Basyouny 2013, 'Full Bayes Before-and-After Evaluation of Traffic Safety Improvements in City of Edmonton, Canada', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2386, no. 1, pp. 189–194, doi:10.3141/2386-21

[29] * Mohamed H. Zaki, Tarek Sayed, Ahmed Tageldin & Mohamed Hussein 2013, 'Application of Computer Vision to Diagnosis of Pedestrian Safety Issues', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2393, no. 1, pp. 75–84, doi:10.3141/2393-09

[30] Khanloo, B.Y.S., Stefanus, F., Ranjbar, M., Li, Z.-N., Saunier, N., Sayed, T. & Mori, G. 2012, 'A large margin framework for single camera offline tracking with hybrid cues', *Computer Vision and Image Understanding*, vol. 116, no. 6, pp. 676-689

[31] El-Basyouny, K. & Sayed, T. 2012, 'Measuring direct and indirect treatment effects using safety performance intervention functions', *Safety Science*, vol. 50, no. 4, pp. 1125-1132

[32] El-Basyouny, K. & Sayed, T. 2012, 'Measuring safety treatment effects using full Bayes non-linear safety performance intervention functions', *Accident Analysis and Prevention*, vol. 45, pp. 152-163

[33] * El Esawey, M. & Sayed, T. 2012, 'Neighbour corridors travel time estimation: Concept and a case study', *Advances in Transportation Studies*, pp. 81-96

[34] Autey, J., Sayed, T. & Zaki, M.H. 2012, 'Safety evaluation of right-turn smart channels using automated traffic conflict analysis', *Accident Analysis and Prevention*, vol. 45, pp. 120-130

[35] * Simon Li, Tarek Sayed, Mohamed H. Zaki, Greg Mori, Ferdinand Stefanus, Bahman Khanloo & Nicolas Saunier 2012, 'Automated Collection of Pedestrian Data through Computer Vision Techniques', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2299, no. 1, pp. 121–127, doi:10.3141/2299-13

[36] * Tarek Sayed, Karim Ismail, Mohamed H. Zaki & Jarvis Autey 2012, 'Feasibility of Computer Vision-Based Safety Evaluations', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2280, no. 1, pp. 18–27, doi:10.3141/2280-03

[37] El-Basyouny, K. & Sayed, T. 2011, 'A full Bayes multivariate intervention model with random parameters among matched pairs for before-after safety evaluation', *Accident Analysis and Prevention*, vol. 43, no. 1, pp. 87-94

[38] Ismail, K., Sayed, T., Zaki, M. & Alrukaibi, F. 2011, 'Automated detection of spatial traffic violations through use of video sensors', *Transportation Research Record*, pp. 87-98

[39] Ibrahim, S.E.-B. & Sayed, T. 2011, 'Developing safety performance functions incorporating reliability-based risk measures', *Accident Analysis and Prevention*, vol. 43, no. 6, pp. 2153-2159

[40] Nicolas Saunier, Ali El Husseini, Karim Ismail, Catherine Morency, Jean-Michel Auberlet & Tarek Sayed 2011, 'Estimation of Frequency and Length of Pedestrian Stride in Urban Environments with Video Sensors', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2264, no. 1, pp. 138–147, doi:10.3141/2264-16

[41] El-Basyouny, K. & Sayed, T. 2010, 'A method to account for outliers in the development of safety performance functions', *Accident Analysis and Prevention*, vol. 42, no. 4, pp. 1266-1272

[42] El-Basyouny, K. & Sayed, T. 2010, 'Application of generalized link functions in developing accident prediction models', *Safety Science*, vol. 48, no. 3, pp. 410-416

[43] Lovegrove, G., Lim, C. & Sayed, T. 2010, 'Community-based, macrolevel collision prediction model use with a regional transportation plan', *Journal of Transportation Engineering*, vol. 136, no. 2, pp. 120-128

[44] El-Basyouny, K. & Sayed, T. 2010, 'Safety performance functions with measurement errors in traffic volume', *Safety Science*, vol. 48, no. 10, pp. 1339-1344

[45] Khondakar, B., Sayed, T. & Lovegrove, G. 2010, 'Transferability of community-based collision prediction models for use in road safety planning applications', *Journal of Transportation Engineering*, vol. 136, no. 10, pp. 871-880

[46] Karim El-Basyouny & Tarek Sayed 2010, 'Full Bayes Approach to Before-and-After Safety Evaluation with Matched Comparisons: Case Study of Stop-Sign In-Fill Program', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2148, no. 1, pp. 1–8, doi:10.3141/2148-01

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[1] Sayed, T., Autey, J., Hediyeh, H., Zaki, M.H. & Ismail, K. 2012, 'Demonstrating before and after safety behavioral analysis using computer vision', *19th Intelligent Transport Systems World Congress, ITS 2012*

[2] Ismail, K., Sayed, T. & Saunier, N. 2009, 'Automated pedestrian safety analysis using video data in the context of scramble phase intersections', *TAC/ATC 2009 - 2009 Annual Conference and Exhibition of the Transportation Association of Canada: Transportation in a Climate of Change*

[3] Saunier, N. & Sayed, T. 2008, 'A probabilistic framework for vision-based road safety analysis', *Efficient Transportation and Pavement Systems: Characterization, Mechanisms, Simulation, and Modeling - Proceedings of the 4th International Gulf Conference on Roads*, pp. 227-239

[4] Saunier, N. & Sayed, T. 2006, 'A feature-based tracking algorithm for vehicles in intersections', *Third Canadian Conference on Computer and Robot Vision, CRV 2006*, vol. 2006

[5] Saunier, N. & Sayed, T. 2006, 'Clustering vehicle trajectories with hidden Markov models application to automated traffic safety analysis', *IEEE International Conference on Neural Networks - Conference Proceedings*, pp. 4132-4138

F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

Part F - Participant Details including ROPE (Prof Trisalyn Nelson)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Partner Investigator

Title

Prof

First Name

Trisalyn

Second Name

Family Name

Nelson

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
06/02/2005	Doctoral Degree	Ph.D.	Geography and Environmental Studies	Wilfrid Laurier University	Canada
15/05/2001	Masters Degree	MSc	Geography	University of Victoria	Canada
15/05/1998	Bachelor Degree	BSc	Geography	University of Victoria	Canada

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

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F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area** (Yes/No)	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
Prof M. Winters, Prof D. Fuller, Prof L. Gauvin, Prof. D. Whitehurst, **Prof T. Nelson**; *"Impacts of City-Wide Bicycle Infrastructure Investment on Population Health & Health Equity."*; CIHR Project Scheme 2017-2022	Y	C		85	85	85				
Spatial Analysis Research Center (SPARC), Arizona State University. Founder and Center Supervisor. $1,000,000 USD. 2016-2021	Y	C		200	200					

Y. Kestens, M. Winters, D. Fuller, **Nelson T**. CIHR Team Grant: *Environments and Health: Programmatic Grants in Intersectoral Prevention Research. INTERACT: INTErventions, Research, and Action in Cities Team.* $2,000,000 CAD. 2016-2021	Y	C		400	400					
University of Victoria, *Landsdowne Research Chair in Spatial Science.* Sole Investigator, $150,000 CAD	Y	C		30						

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.1

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
Arizona State University		Employee	1.0

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

Arizona State University

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

No

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should this application be successful the participant will exceed ARC project limits and must meet the project limits under the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Yes

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

No PDF file uploaded.

F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Director	School of Geographical Sciences and Urban Planning	Permanent	Full Time	07/01/2016		Arizona State University
Professor	Geography	Permanent	Full Time	30/06/2015	30/06/2016	University of Victoria, Canada

Assistant Professor	Geography	Permanent	Full Time	02/06/2005	30/06/2015	University of Victoria, Canada

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

No

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

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F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

I have spent 15 years conducting active research since graduating with my Ph.D. in Geography and Environmental Studies from Wilfrid Laurier University in 2005. I have experienced 0.0 FTE periods of unemployment or interruptions to my career during this time.

Research Opportunities

Since 2016, I have been the Director of the School of Geographical Sciences and Urban Planning at Arizona State University, as well as a Foundation Professor within the school. I maintain this 1.0 FTE position, which involves administration, teaching, and research.

Immediately upon completing my PhD in 2005, my professional research career began by joining the Department of Geography at the University of Victoria (Canada) as an Assistant Professor. I was promoted to Associate Professor and awarded tenure in 2009 and Full Professor in 2015. In recognition of my outstanding research contributions, I was twice awarded the five-year Lansdowne Research Chair in Spatial Sciences (in 2010 and 2015), which enabled me to devote more of my time to research. As Director of the Geomatics Program from 2013 to 2016, I was instrumental in bridging both research and teaching collaborations between the Department of Geography and Computer Science. I continue to be an adjunct professor at the University of Victoria.

Upon joining Arizona State University in 2016, I created and currently supervise the Spatial Analysis Research Center (SPARC) and I oversee two additional centers: the Center for Global Discovery and Science Conservation (CGDSC) and the Urban Climate Research Center (UCRC).

Research Achievements and Contributions

As a leader in the field of geographical sciences, I have worked closely throughout my career with university and government researchers from a wide range of fields and disciplines to demonstrate the benefits of spatial analysis. My PhD and early scholarship focused on forestry, insect infestations, climate change, and spatial ecology. I have led the development of spatial methods to address research questions from epidemiology, food security, landscape ecology, wildlife, crime, and radon exposure. While I continue to work on wildlife movement, much of my research now focuses on cities and public health, such as developing analytical and mapping tools for active transportation planning.

Research outputs and income

The extent and impact of my research outputs throughout my career has been substantial. My research has generated over 145 peer-reviewed papers and Google Scholar indicates 3985 citations, an h-index of 33, and an i10-index of 96. My ResearchGate Score is currently 38.77. I have co-authored >140 conference presentations and >40 reports. My collaborative research has been supported by > $13 (AUS) million in funding, from both Canadian and American funding agencies. This funding includes over $1.3M from the Public Health Agency of Canada (primary investigator) to develop BikeMaps.org to support healthy living in nine cities and two Canadian Institutes of Health Research grants (co-investigator) to assess the impact of bicycling infrastructure in Victoria (BC, Canada).

Research impact and advancement of knowledge

I am committed to knowledge mobilization and communicating the societal impact of research. Perhaps the best example is BikeMaps.org, an innovative platform that I founded, which collects crowdsourced reports of bicycling collisions, falls, and near misses. Through this exciting research endeavour, I have gained considerable expertise in citizen science, knowledge translation, and active transportation safety. Since BikeMaps.org began in 2014, almost 10,000 reports have been made in cities around the world, including Vancouver, Phoenix, Reykjavik, and Dublin, which contributes to the global body of knowledge on bicycling safety. BikeMaps.org has been the subject of over 70 media articles or interviews and I have gained broad media and communication experience, including dealing with politically charged issues and communicating with politicians, decision makers, and the public. The resulting data and analytics have been used by municipal governments in Canada, the US, and Iceland.

Selection of relevant peer-reviewed manuscripts:

Branion-Calles, M., Nelson, T.A., and Winters, M. (2017). **Comparing crowdsourced near miss and collision cycling data and official bike safety reporting.** Transportation Research Record: Journal of the Transportation Research Board. No. 17-03486.

Ferster, C.J., Nelson, T.A., Winters, M., and Laberee, K. (2017). **Geographic age and gender representation in volunteered cycling safety data: A case study of BikeMaps.org.** Applied Geography. 88: 144–150.

Jestico, B., Nelson, T.A., Potter, J., and Winters, M. (2017). **Multiuse trail intersection safety analysis: A crowdsourced data perspective.** Accident Analysis and Prevention. 103: 65–71.

Nelson, T.A., Denouden, T., Jestico, B., Laberee, K., and Winters, M. (2015). **BikeMaps.org: a global tool for collision and near miss mapping.** Frontiers in Public Health.doi:10.3389/fpubh.00053.

In addition to collecting crowdsourced reports of bicycle collisions, we have recognized the need for improved ridership data to better understand risk. We have also uncovered the challenge of consistent datasets of bicycle infrastructure across jurisdictions. As such, we are exploring the use of emerging datasets such as Strava and OpenStreetMaps in combination with more traditional data and assessing their utility for urban planning.

Selection of relevant peer-reviewed manuscripts:

Ferster, C., Fischer, J., Manaugh, K., Nelson, T., and Winters, M. (2019) **Using OpenStreetMap to inventory bicycle infrastructure: a comparison with open data from cities.** International Journal of Sustainable Transportation (18-01501).

Jestico, B., Nelson, T.A., and Winters, M. (2016). **Mapping ridership with crowdsourced cycling data**. Journal of Transport Geography. 52: 90-97 doi:10.1016/j.jtrangeo.2016.03.006

Boss, D., Nelson, T., Winters, M., and Ferster, C. (2018). **Using crowdsourced data to monitor change in spatial patterns of bicycle ridership.** Journal of Transport and Health. 9: 226–233.

Roy, A., Nelson, T.A., Fotheringham, A.S., and Winters, M. (2019). **Correcting bias in crowdsourced data to map bicycle ridership of all bicyclists.** Urban Science. 3(2): 62. https://doi.org/10.3390/urbansci3020062

Invited speaker

I am routinely invited to speak at conferences and to governments, businesses, and community organizations. I have presented over 40 times and share the following selection:

2019 Improving Bicycling with Crowdsourced Data, Southern Arizona Bike Summit, Tucson, AZ, November.

2018 Big Data for Bicycling, Strava Inc. San Francisco, CA. May.

2018 Bicycling Safety. State Farm Insurance, Tempe, AZ. April.

2016 Geography Colloquium Series, University of Arizona. From Bears to Bikes: Applied Spatial Data Science. Tucson, AZ. October 28.

2016 Dean's Lecture Series, University of Victoria. BikeMaps.org: What we've learned. Victoria, BC. January 22.

2015 Geographers Without Borders, University of Waterloo. BikeMaps.org. Waterloo, ON. July 3.

2014 Capital Regional District (CRD) Traffic Safety Commission. Bike Mapping in the CRD. November 13.

2013 Fields Institute for Research in Mathematical Sciences. Workshop on Establishing the Scientific Foundation for Quantitative Public Health Decision-Making. Statistical Modeling, Spatial Data. Toronto, ON. April 29.

2012 Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement, Aix-Marseille University. Spatial Analysis of Wildlife Data. Aix en Provence, France. September 18.

2012 Geography, St. Andrews University. Biodiversity to Bears: Spatial Analysis for Ecology. St. Andrews, Scotland. July 20.

2010 School of Environment and Sustainability, University of Saskatchewan. Environmental solutions: collaborative and interdisciplinary spatial science. Saskatoon, SK. March 25.

Prizes, honours, and awards

In recognition for my work advancing bicycle safety knowledge, I was awarded the Research Professional of the Year in 2018, by the Association of Pedestrian and Bicycle Professionals. More locally I was thrilled to receive the Bike Hero Award from the City of Tempe because of my efforts to quantify and monitor patterns of urban cycling safety and ridership that inform local governments of areas exhibiting safety concerns.

I have received honours and awards for other aspects of my research as well. My contributions to ecological research were recognized in 2016 when our research team received the Ecological Society of America's Cooper Award for Outstanding Publication (Trant *et al.* 2016). In 2018 I received the Arizona Geographical Alliance Friend Award and was awarded the Research Excellence Award in 2012 from the Faculty of Social Sciences at the University of Victoria.

Trant, A.J., Nijland, W., Hoffman, K.M., Mathews, D.L., McLaren, D., Nelson, T.A., Strazomski, B.M. (2016). **Intertidal resource use over millennia enhances forest productivity**. Nature Communications. 7:12491 doi: 10.1038/ncomms12491. (Ecological Society of America – Cooper Award for outstanding publication)

Other professional activities and leadership

I have been fortunate to have strong mentorship in my early career and always strive to provide the same opportunities, support, and guidance to my students and staff. I have directly supervised 6 post-doctoral fellows, 6 PhD students, and 18 MSc students. Five of my former students are now university faculty in Canada (UBC Okanagan, Western University, University of Montreal, and Wilfrid Laurier University) and in the United States (University of Colorado Boulder). All MSc students who have opted to complete a PhD have secured national scholarship funding.

I am delighted to share my growing expertise in the fields of transportation and active transportation and am a member of the Maricopa Association of Governments, Pedestrian and Bicyclist Safety Education and Enforcement Task Force and the ASU Transportation Demand Management Stakeholder Advisory Committee. I am also currently a member of the American Bicycle and Pedestrian Association and was a member of the Victoria Bicycle Network Stakeholder Advisory Committee (2015-2016).

Recognizing the value of knowledge mobilization, I recently founded a podcast, "Earth + Humans". The objective of the podcast is to share ongoing research in plain language with the public. I have hosted five episodes to date and have interviewed research leaders on topics ranging from "Climate Change and Cities" to "Community Health Planning".

I have served on the Editorial Board of Geographical Analysis and have been a grant and journal reviewer throughout my career. I have been on the Programming Committee for:

- GIScience Workshop; Analysis of Movement Data (AMD'14). Vienna, Austria. September. (2014).
- (Founder and Organizer) UVic Geography Student Conference—Bridging the Gap. Victoria, BC. (2007-2010).
- Spatial Knowledge and Information Canada (2008).

I am increasingly sought out to provide leadership across the ASU community and am currently an invited fellow for the ASU Advanced Leadership Initiative and was an invited speaker in 2019 for the ASU Launching Leaders Program. Additional service contributions at ASU include:

- Committee Member to Establish Interdisciplinary Data Science Degree. (2018 – present)
- Geographic Information Science Campus Working Group, ASU, Founder and Lead. (2018 – present)
- Chair of Director Search, School of History, Philosophy, and Religious Studies, ASU. (2018)
- Chair of Director Search, School of Transborder Studies, ASU. (2017)
- Search Committee member, Head of Architecture, ASU. (2017)
- ASU College of Liberal Arts and Science, Online Task Force. (2016)
- ASU College of Liberal Arts and Science, Hiring committee, Director of Online Curriculum and Digital Innovation. (2016)

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

Dr. Trisalyn Nelson enjoys working collaboratively and has worked with more than 100 co-authors on more than 110 publications. She has secured $13.2 million research dollars ($9.3 million jointly and $3.9 solely) from organizations including NSERC, GEOIDE, and NSF. She is particularly energized by working with industry partners to develop and solve applied research questions. She has partnered with software companies, mapping agencies, urban planning consultants, police departments, and insurance agencies. She also works with cities and national governments on issues ranging from safe cycling to forest management.

She has published in dozens of prestigious journals including PLoS One, the Annals of GIS, Proceedings of the National Academy of Sciences, and the Journal of Geographical Analysis. Dr. Nelson also served on the editorial board for Geographical Analysis in 2014. Her most recent first author publications include a chapter in Mapping and Modelling Forest Landscape Patterns (2017) and papers in Frontiers in Public Health (2015; doi:10.3389/fpubh.00053) and the Annals of GIS (2015).

Dr. Nelson has extensive knowledge in developing analytical tools that can be applied to advance knowledge and decision making in fields such as epidemiology (Robertson et al. 2012), food security (Morrison et al. 2012), coastal monitoring (Nelson et al. 2011a), wildfire (Gralewicz et al. 2012), crime (Fitterer et al. 2017), and wildlife ecology (Long & Nelson 2012). Her lab also developed the Spatial-Temporal Analysis of Moving Polygons (STAMP) method; a novel spatial analytic approach that can be adapted for use in a variety of disciplines.
In 2014, she assembled a team to develop a webmap and mobile apps to capture citizen science reports of bike incidents, including accidents and thefts. BikeMaps.org has expanded into a global research project with colleagues participating from various academic and research institutions. The success of this product has enabled Dr. Nelson to work with municipal governments, private industry, and advocates for active transportation to improve the data on cycling that is available for planning and research. Her recent publications on this topic include "Impacts of study design on sample size, participation bias, and outcome measurement: A case study from bicycling research" (Branion-Calles et al., 2019) in the Journal of Transport and Health, as well as "Using OpenStreetMap to inventory bicycle infrastructure: a comparison with open data from cities" (Ferster et al., 2019) in the International Journal of Sustainable Transportation.

In her leadership role, Dr. Nelson is passionate about creating a positive, collaborative culture. She values partnerships, particularly connection between industry and academics, that enable innovation of methods and approaches to solving critical issues. She has worked with over a dozen partners to leverage data science methods for business and management solutions and she is committed to finding new ways to tell stories about the amazing work happening all around us. One of these knowledge mobilization initiatives involves hosting a podcast (Earth + Humans) to discuss topics relevant to geography, GIScience, and urban planning.

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Jestico, B., Nelson, T. & Winters, M. 2016, 'Mapping ridership using crowdsourced cycling data', *Journal of Transport Geography*, vol. 52, pp. 90-97 (Refereed Journal Article)

[2] * Conrow, L., Wentz, E., Nelson, T. & Pettit, C. 2018, 'Comparing spatial patterns of crowdsourced and conventional bicycling datasets', *Applied Geography*, vol. 92, pp. 21-30 (Refereed Journal Article)

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Additional Research Outputs

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F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

Part F - Participant Details including ROPE (A/Prof Meghan Winters)

F1. Personal Details

(To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.
Note: The Date of Birth, Country of Birth and Indigenous Status parts of the question and corresponding answers will not appear in the PDF version of the form)

Participation Type

Partner Investigator

Title

A/Prof

First Name

Meghan

Second Name

Winters

Family Name

Winters

F4. Qualifications

(To update any qualifications, click on the 'Manage Qualifications' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)

Conferral Date	AQF Level	Degree/Award Title	Discipline/Field	Awarding Organisation	Country of Award
19/05/2011	Doctoral Degree	Doctor of Philosophy (PhD)	Population and Public Health	University of British Columbia	Canada
22/06/2006	Masters Degree	Master of Science	Health Care and Epidemiology	University of British Columbia	Canada
24/06/1999	Bachelor Honours Degree,Graduate Certificate, Graduate Diploma	Bachelor of Science	Chemistry and Oceanography	University of British Columbia	Canada

F5. Research Load (non-ARC Grants and Research)

(Provide details of research funding from non-ARC sources (in Australia and overseas). For research funding from non-ARC sources, list all projects/applications/awards/fellowships awarded or requests submitted involving that participant for funding for the years 2020 to 2026 inclusive.)

Uploaded PDF file follows on next page.

F5. Research Load (non-ARC Grants and Research)

Funding from Non-ARC Sources

Description (All named investigator s on any application or grant/fellow ship in which a participant is involved, project title, source of support, scheme and round)	**Same Research Area** (Yes/No)	**Support Status** (Requested/Current/Past)	Application/ **Project ID** (for NHMRC applications only)	**2020** $'000	**2021** $'000	**2022** $'000	**2023** $'000	**2024** $'000	**2025** $'000	**2026** $'000
Prof M. Winters, R. Riley; "Exploring community engagement approaches to better understand impacts of changes to the built environment: case studies of Victoria and Vancouver"; MITACS Globalink International 2020	No	C	NA	6						
Prof M. Winters, M. Branion-Calles; "Evaluating the impact of bicyclist behaviour on safety." MITACS Globalink 2020	Yes	C	NA	6						
Prof M. Winters; "Readiness for shared micromobility: public perceptions in Metro Vancouver." Translink New Mobility Research Grant 2020	No	C	NA	25						

K. Lee, N. Freudenberg, K Buse, J. Collin, E. Crosbie, T.H. de Sa, J Fang, S. Friel, J. Lima Madureira, M. Mialon, J. Smith, **Prof M. Winters;** "Defining and measuring the commercial determinants of health as risk factors for non-communicable diseases: Advancing a new framework for addressing the global epidemiological transition."; CIHR Planning and Dissemination Grant: Global Health 2020-2021	No	C	NA	15	5					
Prof M. Winters, S. Tremblay; "Public perceptions on shared micromobility."; MITACS 2019-2020	No	C	NA	22						
Prof M. Winters, Prof M. Holden; "Hey Neighbour Collective"; MITACS Cluster 2019-2022	No	C	NA	23	23	23				
Prof M. Winters, Prof M-S. Cloutier; "Smart Cities, Healthy Citizens? Optimizing Health and Equity in City Policy Making."; CIHR Planning & Dissemination Grant; Healthy Cities 2019-2020	No	C	NA	7						

Y. Kestens, R. Brondeel, M. De Groh, A. El-Geneidy, D. Fuller, G. Moullec, R. Wasfi, **Prof M. Winters**, J. Derome, L. Drouin; "Sustainable Healthy Cities: The Interplay between Urban Interventions, Gentrification, and Population Health."; CIHR Project Scheme 2019-2023	No	C	NA	150	150	150	75			
Prof M. Winters, Prof D. Fuller, Prof L. Gauvin, Prof. D. Whitehurst, Prof T. Nelson; "Impacts of City-Wide Bicycle Infrastructure Investment on Population Health & Health Equity."; CIHR Project Scheme 2017-2022	Yes	C	NA	85	85	30				
Prof. M. Winters, Prof D. Fuller, Prof Y Kestens; "INTERACT: INTERventions, Research, and Action in Cities Team."; CIHR Team Grant: Environments and Health: Programmatic Grants in Intersectoral Prevention Research 2016-2021	No	C	NA	400	400					

F6. What is the participant's time commitment to this project?

(Enter the participant's time commitment to this project as a Full-Time Equivalent (FTE). Note that a FTE of 1.0 represents a full-time commitment (i.e. 5 days per week).)

0.1

F7. Eligibility - Employment Details as at grant commencement date

(This question will be used to determine your eligibility. Your eligibility will be based solely on the information contained in this application. Confirm your employment status at all organisations that you will be associated with as at the 1 January 2021. Enter the relevant appointment type and Full-Time Equivalent (FTE) for each organisation.)

Org name	Is this an Eligible Organisation?	Please choose your appointment type for this organisation.	Please enter your FTE for this Organisation
Simon Fraser University, Canada		Employee	1.0

F8. Eligibility - Relevant Organisation for this application as at grant commencement date for this project

(Enter the Organisation that is relevant to your participation on this application, and that you will be associated with as at 1 January 2021. The 'relevant organisation' is the primary organisation that will be supporting your involvement in this project if it is funded. Note that the Organisation must be listed in F7 for this question to validate.)

Relevant Organisation

Simon Fraser University, Canada

F9. Eligibility - Currently held ARC Projects

(This information is auto-populated. If you have any concerns with the information recorded here, please contact your Administering Organisation's Research Office.)

F10. Eligibility - Will the participant be residing predominantly in Australia for the duration of the project activity period?

(This is a 'Yes' or 'No' question. Indicate whether the participant will be residing predominantly in Australia for the project activity period. If the participant is applying as a CI and you answer 'No' to this question they will be prompted to contact Your Research Office to check their eligibility.)

No

F11. Eligibility - Will the participant undertake a Higher Degree by Research during the project activity period?

(This is a 'Yes' or 'No' question. If the participant is applying as a CI and their answer is 'Yes' to this question they will be prompted to contact their Research Office. Eligibility will be based solely on the information contained in this application.)

No

F12. Eligibility - Project Relinquishment or Application Withdrawal

(ARC grant guidelines specify the limits on the number of applications and projects per named participant. Should this application be successful the participant will exceed ARC project limits and must meet the project limits under the grant guidelines before the project can start. Project limits can be met by relinquishing existing active project(s), or relinquishing role(s) on existing active projects, or withdrawing application(s) that would exceed the project limits.)

F13. Eligibility - Further Details Regarding Partner Investigator Status - Does the participant hold a remunerated appointment at an Eligible Organisation as at the grant commencement date for this project?

(This is a 'Yes' or 'No' question.
At A2 Partner Investigator has been selected as the role type, but it appears that the participant meets the criteria of a Chief Investigator.
NOTE: this question is mandatory ONLY FOR PIs WHO:
• at F10 confirmed that they will reside predominantly (greater than 50 per cent of their time) in Australia for the project activity period of the proposed project; AND
• at F11 confirmed that they are not currently undertaking a Higher Degree by Research which will be conferred after 1 January 2021; AND
• at F7 indicated that at the grant commencement date they would hold either:
- an appointment at an Eligible Organisation equal or greater than 0.2 FTE; OR
- an honorary academic appointment at an Eligible Organisation
If the participant selects 'Yes', they will be further prompted to justify their participation on this application as a PI with reference to the grant guidelines.)
Do you hold a remunerated appointment at an Eligible Organisation?

Justification of PI status

F14. Is the participant providing research input on this project?

(This is a Yes/No question for Partner Investigators (PI) only. If the PI answers 'Yes', the ROPE questions will be activated. You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section. If the participant answers 'No', they will be asked to upload a CV to support the PI's involvement in the proposed project. The two page CV must be relevant to the application and can include significant career interruptions. It is up to the participant to determine the appropriate information to include in the CV. Please read the Instructions to Applicants for further detail.)

Are you providing Research Input?

Yes

Research Career - Provide a two page CV to support the Partner Investigators involvement in the proposed project. (Upload a PDF of up to two A4 pages)

No PDF file uploaded.

F15. Research Opportunity and Performance Evidence (ROPE) - Current and previous appointment(s) / position(s) - during the past 10 years

(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)

Description	Department	Contract Type	Employment Type	Start Date	End Date	Organisation
Associate Professor	Faculty of Health Sciences	Permanent	Full Time	01/07/2017		Simon Fraser University, Canada
Assistant Professor	Faculty of Health Sciences	Permanent	Full Time	01/07/2011	30/06/2017	Simon Fraser University, Canada

Postdoctoral Fellow	Family Practice	Contract	Full Time	01/04/2011	30/06/2011	The University of British Columbia
Research Coordinator - Cycling in Cities Program	Epidemiology	Contract	Part Time	01/07/2006	31/03/2011	The University of British Columbia

F16. Research Opportunity and Performance Evidence (ROPE) - Academic Interruptions

(You must read the ROPE Statement http://www.arc.gov.au/arc-research-opportunity-and-performance-evidence-rope-statement before filling out this section.)
Has the participant experienced an interruption that has impacted on their academic record?

No

F17. Research Opportunity and Performance Evidence (ROPE) - Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

(Provide details of the participant's academic career and opportunities. This should not include information presented in the following questions (Upload a PDF of up to five A4 pages))

Uploaded PDF file follows on next page.

F17—ROPE—Details of the participant's academic career and opportunities for research, evidence of research impact and contributions to the field, including those most relevant to this application

Amount of Time as an Active Researcher

Associate Professor Meghan Winters graduated 8.5 years ago with a PhD from the University of British Columbia, Canada. Associate Professor Winters has experienced 0.0 FTE periods of unemployment or interruptions to her career during this time.

Research Opportunities

I briefly (3 months) held a post-doctoral associate at the Centre for Hip Health and Mobility, 2011, between defending my PhD and my first academic position.

I joined the Faculty of Health Sciences (FHS) at SFU on July 1, 2011 in the role of a full-time tenure-track Assistant Professor position (workload has been 40:40:20 research: teaching: service). I was granted tenure and promoted to Associate Professor July 1, 2017. Prior to SFU,. I have been a core researcher at the Centre for Hip Health and Mobility since July 2011, an Adjunct Professor at in the Department of Geography at University of Victoria since 2015. I am an Associate Member of Gerontology at SFU (since 2017) and of Urban Studies (since 2017).

I was awarded a Michael Smith Foundation for Health Research Scholar Award over 2016-2022 which enables 75% of my time to be dedicated to research, a shift from the standard 40% research, 40% teaching, 20% service requirement of a faculty member at Simon Fraser University (SFU). In 2016, I launched the Cities, Health, and Active Transportation Research (CHATR) lab (www.chatrlab.ca), which currently comprises 20 trainees and staff working to understand how community design impacts how people get around and connect with each other, and the equity implications of policy and environmental changes in our communities.

Research Achievements and Contributions

My research program addresses evidence gaps on the impacts of population health interventions (both infrastructure and non-infrastructure) on mobility, active travel, and health outcomes, for people of all ages and abilities across diverse urban form settings. The projects within my applied research program have been developed with, by, and for stakeholders across health, transportation, and planning sectors, and reflect both urgent needs and timely opportunities. My content and methodological contributions cover three broad themes: population health intervention research; urban form and location-based physical activity; bicycling and the built environment.

Research outputs and income

I have produced 95 peer-reviewed publications since 2006 (86 since 2011). My work has garnered nearly 3700 citations (Google Scholar Nov 2019, h-index of 29, i10 index of 61).

My research has garnered substantial competitive grant funding ($2.9M as PI, $10.3M as co-I since 2011) and contracts (~$500K) from national and municipal sources. Major funders include the Canadian Institutes of Health Research ($2.5M) and Mitacs ($300K).

Prizes, honours and awards

President's Award for Leadership in Sustainability – Simon Fraser University (2020)

(Nomination) Trailblazer Award – Instituite of Population and Public Health, Canadian Institutes of Health Research (2019)

(Nomination) Royal Society of Canada College (2017)

Michael Smith Foundation for Health Research- Scholar Award ($450000) Transforming urban form for mobility: Interventions to improve population health (2016-2021)

Distinguished Academic - Early in Career Award, Confederation of University Faculty Associations of BC ($1000) (2016)

Outstanding Paper Award, Committee on Bicycle Transportation, Transportation Research Board (2013)

Endowed Research Fellowship, SFU ($5000) (2011-2013)

Canada Graduate Scholarship, Canadian Institute for Health Research ($105000) (2007-2011)

Senior Trainee (Top-up), Michael Smith Foundation for Health Research ($21000) (2007-2011)

Four Year Doctoral Award, UBC ($1000) (2009-2010)

Gold Award, CIHR Student Health Research Forum (2009)

Student Prize, International Conference on Urban Health (2008)

Scholarship, Built Environment Assessment Training Institute ($2500) (2008)

Doctoral Tuition Award, UBC ($16000) (2006-2010)

Paetzold University Graduate Fellowship Award, UBC ($400) (2005-2007)

Bridge Fellow, CIHR/MSFHR Training Program ($17500) (2004-2006)

Murray Stratton Memorial Scholarship, UBC (2005)

Canada Graduate Scholarship Master's Award, CIHR ($17500) (2004-2005)

Department Award, Health Care and Epidemiology, UBC ($500) (2004-2005)

Innovation Award, Inflazyme Pharmaceuticals (2002)

Undergraduate Research Award, NSERC ($4500) (1999)

Invited keynote and speaker addresses

I have delivered 83 invited presentations, including 7 keynotes, and many of these are directly to knowledge users of my research on the urban form including the Canadian Institute of Planners, City of Vancouver, and TransLink. I share a selection below:

Panelist, "Dialogue and data: Recipe for successful healthy city research" CIHR IPPH-hosted panel Healthy Cities Research: The role city research partnerships play in building livable, learning cities. Livable Cities Forum, Victoria, BC. October 29, 2019.

Keynote, "If we build it…who will come? Equity in Spatial Access to Bicycling Infrastructure in Mid-Sized Cities". Planning Institute of British Columbia and the Canadian Institute of Transportation Engineers, Interior BC chapter 2019 Fall Meeting, Health, Equity, and Innovation in the Built Environment. Kelowna, BC. October 10, 2019.

Invited speaker "A Look Ahead for Surveillance for Bicycling in Canada" Public Health Agency of Canada, Surveilllance group (including regional offices), Ottawa, ON. July 5, 2019.

Invited keynote speaker, "Careers in Sustainability". Green Bricks Green Career Conference, March 2, 2019. 200 high school students and mentors.

Invited Panelist, Business in Vancouver Business Excellence Series: Smart Cities "Are Smart Cities Healthy Cities: A caution". October 18, 2018. Over 100 local business leaders.

Discussant, Healthy Cities for All Forum, organized by the City of Vancouver., "Health and the Built Environment: A case study on Arbutus Greenway". June 14, 2018. 120 decision-makers, stakeholders, and researchers, local and international.

Invited Panelist, Science Meets Practice Panel, Velo-City Global Conference, Arnhem-Nijmegen, the Netherlands. June 13-16, 2017.

Keynote, "Ageing and the built environment: Are our neighbourhoods good places to grow old?" Annual Occupational, Environmental and Public Health Conference. Semiahmoo, Washington, Jan 9, 2014.

Other professional activities and leadership

Local and national

- Advisory Committee Member, The Greenest City | Climate Emergency Plan, City of Vancouver (2019-2020)
- Advisory Committee Member, 10th Ave Evaluation, City of Vancouver (2018-2019)

- Review committee, Population Health Stream – Michael Smith Foundation for Health Research Trainee awards (19 applications) (2018).
- Invited advisor, Canadian Institute of Planners Policy on Healthy Communities (Preliminary Policy Statement (2018)
- Invited, Consultation on Future Priorities for Global Health Research in Canada, Canadian Institutes of Health Research and IRDC (2018)
- CityStudio Operations Council (2015-present)
- Member, Research Facilities Committee, Centre for Hip Health and Mobility (2015-present)
- Invited member, BC Physical Activity Strategy Action Plan Team: Built and Natural Environment (2014)
- Invited participant, Canadian/BC Road Safety Research Priority Setting (2014)
- Vice-Chair, Active Transportation Policy Council, City of Vancouver (2014-2016)
- Steering Committee Member, Healthy Built Environment Alliance (2013-present)
- Board Member, PopulationData BC (2012-2016)
- Member, Active Transportation Policy Council, City of Vancouver (2012-2014)
- Transportation Stakeholder Advisory Committee, City of Vancouver (2011-present)
- Bicycle Advisory Committee Member, City of Vancouver (2009-2011)
- Advisory Committee Member, Downtown Eastside Pedestrian Injury Study (2009-2010)
- Participant, Health and the Built Environment Forum, Provincial Health Services Authority (2009)
- Stakeholder, Regional Bicycle Plan Stakeholder Workshops, TransLink (2008-2009)
- Presenter, Built Environment & Active Transportation Summit, BC Parks and Recreation (2008)
- Member, "Do Bugs Need Drugs" Evaluation Committee, BCCDC (2006-2007)

International

- Editorial Board, Journal of Transportation and Health (2019 - present)
- Special issue co-editor, Journal of Transport Geography, "Critical Vélomobilities" (2019-2020)
- Guest editor, Social Science and Medicine, Special Selection from International Medical Geography Symposium, with co-editor Dr. Valorie Crooks (2015-2016)
- Program Review Committee, ProWalk ProBike ProPlace Conference (2016)
- Chair, Local Host Organizing Committee, ProWalk ProBike ProPlace Conference (2014-2016)
- Paper Review Coordinator, Committee on Bicycle Transportation, US Transportation Research Board (2016, 2017, 2018, 2019). *Lead editor managing review process for 10-12 papers per year for Transportation Research Record journal (~ 80-100 hours annually)*
- Nominated member, Standing Committee on Bicycle Transportation, US Transportation Research Board (2015-present) *(service ~ 25 hours per year)*
- Planning Committee, 2015 International Medical Geography Symposium (2014-2016)
- Organizing Committee, ACSM-TRB Conference, Moving Active Transportation to Higher Ground: Opportunities for Accelerating the Assessment of Health Impacts (2014-2015)
- Research Advisory Committee Member, Velo-City Global Conference (2010-2012)

Research impact and advancement of knowledge

Scientific Influence: Some of the most influential publications those on bicycle infrastructure types that are both safe and preferred; my research in the area includes one of the first North American studies to feature cycle tracks, infrastructure that is now widely prevalent in our cities. Another is the BIKE case-crossover study, the first of its kind in cycling research, which studied injured cyclists in Toronto and Vancouver in 2012; this approach been replicated across 5 US cities, and I co-lead a similar study on child cyclists. Finally, my 2013 study that inventoried cycling training programs and assessed gaps with safety evidence received the Outstanding Paper Award from the Bicycle Research Committee, US Transportation Research Board.

Social Influence: The broader impact of my research is demonstrated by ever increasing invitations to speak (>70 invited presentations, including 7 keynotes), often by knowledge users outside of the health sector who shape our built environments (e.g., Canadian Institutes of Transportation Engineers, Canadian Institute of Planners, municipal advisory committees). I have been effective at delivering research evidence in a timely manner directly to people who need it, namely elected officials and other decision-makers, who rarely access peer-reviewed publications. With my CHATR team, I have honed a report style that is transparent, visually compelling, and written in lay language. These

reports are the key documents that resonate, and we see this content used widely in partners' policies and presentations to inform public consultations, city-wide 'report cards' and reports to council, and in media materials. Such outputs are rarely considered for academic promotion, yet these products comprise a major component of my workload: we currently generate 5-7 ~20-30 page reports annually. Finally, my work is informing the content and structure of the BC Ministry of Transportation's first ever active transportation strategy in 2019, "Move. Commute. Connect". Following its launch, I was asked to guide the themes and specific survey questions that will form the first ever BC-wide Active Transportation Survey led by BC Stats in 2020, and to provide feedback on suggested amendments to the BC Motor Vehicle Act.

F18. Research Opportunity and Performance Evidence (ROPE) - Research Output Context

(Research context: Provide clear information that explains the relative importance of different research outputs and expectations in the participant's discipline/s. The information should help assessors understand the context of the participant's academic research achievements but not repeat information already provided in this application. It is helpful to include the importance/esteem of specific journals in their field; specific indicators of recognition within their field such as first authorship/citations, or significance of non-traditional research outputs. (Up to 3,750 characters, approximately 500 words).)

I am passionate about advancing action on population health challenges (physical inactivity, chronic disease, traffic injuries, and environmental harms) through healthy built environments. My applied research program addresses evidence gaps on impacts of population health interventions on mobility, active travel, and health. Projects have been developed by and with stakeholders across health, transportation, and planning sectors.

I have produced 95 peer-reviewed publications since 2006 (86 since 2011). Many of these papers have been published in leading transport and health journals, including Accident Analysis and Prevention, Injury, Journal of Transport and Health, BMC Public Health, and Transportation Research Record. My work has garnered nearly 3700 citations (Google Scholar Nov 2019, h-index of 29, i10 index of 61). A marker of my influence, in 2019 I was recognized as the 2nd-most published author in bicycle research (34 publications).

I am deeply committed to work that directly supports my partners outside academia. My contributions to the community beyond the academy were formally recognized with the Confederation of University Faculty Associations of British Columbia 2016 Distinguished Academics – Early in Career Award.

F19. Research Opportunity and Performance Evidence (ROPE) – Research Outputs Listing including Ten Career-Best Research Outputs

(Provide a list of research outputs relevant to this application categorised under the following headings: Ten career-best research outputs; Authored books; Edited books; Book chapters; Refereed Journal articles; Fully refereed conference proceedings; Additional research outputs (including non-traditional research outputs). CVs and theses should not be included in this list. The participant's ten career-best research outputs should not be repeated under subsequent headings. (Up to 100 research outputs).)

Research Outputs Listing

Generated research output document follows on the next page

Ten Career-Best Research Outputs

[1] * Ben Jestico, Trisalyn Nelson & Meghan Winters 2016, 'Mapping ridership using crowdsourced cycling data', *Journal of Transport Geography*, vol. 52, pp. 90–97, doi:10.1016/j.jtrangeo.2016.03.006 (Refereed Journal Article)

[2] * Avipsa Roy, Trisalyn A. Nelson, A. Stewart Fotheringham & Meghan Winters 2019, 'Correcting Bias in Crowdsourced Data to Map Bicycle Ridership of All Bicyclists', *Urban Science*, vol. 3, no. 2, pp. 62, doi:10.3390/urbansci3020062 (Refereed Journal Article)

[3] * Darren Boss, Trisalyn Nelson & Meghan Winters 2018, 'Monitoring city wide patterns of cycling safety', *Accident Analysis & Prevention*, vol. 111, pp. 101–108, doi:10.1016/j.aap.2017.11.008 (Refereed Journal Article)

[4] * Darren Boss, Trisalyn Nelson, Meghan Winters & Colin J. Ferster 2018, 'Using crowdsourced data to monitor change in spatial patterns of bicycle ridership', *Journal of Transport & Health*, vol. 9, pp. 226–233, doi:10.1016/j.jth.2018.02.008 (Refereed Journal Article)

[5] * Vanessa Brum-Bastos, Colin J. Ferster, Trisalyn Nelson & Meghan Winters 2019, 'Where to put bike counters? Stratifying bicycling patterns in the city using crowdsourced data', *Transport Findings*, doi:10.32866/10828 (Refereed Journal Article)

[6] * Meghan Winters, Kay Teschke, Michael Grant, Eleanor M. Setton & Michael Brauer 2010, 'How Far Out of the Way Will We Travel?', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2190, no. 1, pp. 1–10, doi:10.3141/2190-01 (Refereed Journal Article)

[7] * P. A. Cripton, H. Shen, J. R. Brubacher, M. Chipman, S. M. Friedman, M. A. Harris, M. Winters, C. C. O. Reynolds, M. D. Cusimano, S. Babul & K. Teschke 2015, 'Severity of urban cycling injuries and the relationship with personal, trip, route and crash characteristics: analyses using four severity metrics', *BMJ Open*, vol. 5, no. 1, pp. e006654–e006654, doi:10.1136/bmjopen-2014-006654 (Refereed Journal Article)

[8] * Michael Branion-Calles, Trisalyn Nelson & Meghan Winters 2017, 'Comparing Crowdsourced Near-Miss and Collision Cycling Data and Official Bike Safety Reporting', *Transportation Research Record: Journal of the Transportation Research Board*, vol. 2662, no. 1, pp. 1–11, doi:10.3141/2662-01 (Refereed Journal Article)

[9] * Kay Teschke, Theresa Frendo, Hui Shen, M Anne Harris, Conor CO Reynolds, Peter A Cripton, Jeff Brubacher, Michael D Cusimano, Steven M Friedman, Garth Hunte, Melody Monro, Lee Vernich, Shelina Babul, Mary Chipman & Meghan Winters 2014, 'Bicycling crash circumstances vary by route type: a cross-sectional analysis', *BMC Public Health*, vol. 14, no. 1, doi:10.1186/1471-2458-14-1205 (Refereed Journal Article)

[10] * Meghan Winters, Michael Brauer, Eleanor M Setton & Kay Teschke 2013, 'Mapping bikeability: a spatial tool to support sustainable travel', *Environment and Planning B: Planning and Design*, vol. 40, no. 5, pp. 865–883, doi:10.1068/b38185 (Refereed Journal Article)

Book Chapters

[1] * Garrard, J, Conroy, J, Winters, M, Pucher, J & Rissel, C. 2019, 'Older Adults and Cycling' in Pucher, John & Buehler, Ralph (eds.), *City Cycling*

[2] Hirsch, Jana & Winters, Meghan 2018, 'Walkability and Physical Activity' in Crooks, Valorie A., Andrews, Gavin & Pearce, Jamie (eds.), *Routledge Handbook of Health Geography*, Routledge

[3] * Winters, M & Rothman, L, 'Physical and Built Environments: Street Design.' in Leaders in Injury Prevention, Parachute (ed.), *Canadian Injury Prevention Resource*

Refereed Journal Articles

[1] * Michael Branion-Calles, Meghan Winters, Trisalyn Nelson, Audrey de Nazelle, Luc Int Panis, Ione Avila-Palencia, Esther Anaya-Boig, David Rojas-Rueda, Evi Dons & Thomas Götschi 2019, 'Impacts of study design on sample size, participation bias, and outcome measurement: A case study from bicycling research', *Journal of Transport & Health*, vol. 15, pp. 100651, doi:10.1016/j.jth.2019.100651

[2] * Michael Branion-Calles, Trisalyn Nelson, Daniel Fuller, Lise Gauvin & Meghan Winters 2019, 'Associations between individual characteristics, availability of bicycle infrastructure, and city-wide safety perceptions of bicycling: A cross-sectional survey of bicyclists in 6 Canadian and U.S. cities', *Transportation Research Part A: Policy and Practice*, vol. 123, pp. 229–239, doi:10.1016/j.tra.2018.10.024

[3] Colin Ferster, Jaimy Fischer, Kevin Manaugh, Trisalyn Nelson & Meghan Winters 2019, 'Using OpenStreetMap to inventory bicycle infrastructure: A comparison with open data from cities', *International Journal of Sustainable Transportation*, vol. 14, no. 1, pp. 64–73, doi:10.1080/15568318.2018.1519746

[4] Thea Franke, Joanie Sims-Gould, Habib Chaudhury, Meghan Winters & Heather McKay 2019, 'Re-framing mobility in

older adults: an adapted comprehensive conceptual framework', *Qualitative Research in Sport, Exercise and Health*, pp. 1–14, doi:10.1080/2159676x.2019.1575269

[5] Brent E. Hagel, Alison Macpherson, Andrew Howard, Pamela Fuselli, Marie-Soleil Cloutier, Meghan Winters, Sarah A. Richmond, Linda Rothman, Kathy Belton, Ron Buliung, Carolyn A. Emery, Guy Faulkner, Jacqueline Kennedy, Tracey Ma, Colin Macarthur, Gavin R. McCormack, Greg Morrow, Alberto Nettel-Aguirre, Liz Owens & Ian Pike et al. 2019, 'The built environment and active transportation safety in children and youth: a study protocol', *BMC Public Health*, vol. 19, no. 1, doi:10.1186/s12889-019-7024-6

[6] Jana A. Hirsch, Joshua Stratton-Rayner, Meghan Winters, John Stehlin, Kate Hosford & Stephen J. Mooney 2019, 'Roadmap for free-floating bikeshare research and practice in North America', *Transport Reviews*, vol. 39, no. 6, pp. 706–732, doi:10.1080/01441647.2019.1649318

[7] * Kate Hosford, Meghan Winters, Lise Gauvin, Andi Camden, Anne-Sophie Dubé, Steven Marc Friedman & Daniel Fuller 2019, 'Evaluating the impact of implementing public bicycle share programs on cycling: the International Bikeshare Impacts on Cycling and Collisions Study (IBICCS)', *International Journal of Behavioral Nutrition and Physical Activity*, vol. 16, no. 1, doi:10.1186/s12966-019-0871-9

[8] Yan Kestens, Meghan Winters, Daniel Fuller, Scott Bell, Janelle Berscheid, Ruben Brondeel, Michael Cantinotti, Geetanjali Datta, Lise Gauvin, Margot Gough, Karen Laberee, Paul Lewis, Sébastien Lord, Hui (Henry) Luan, Heather McKay, Catherine Morency, Nazeem Muhajarine, Trisalyn Nelson, Callista Ottoni & Zoe Poirier Stephens et al. 2019, 'INTERACT: A comprehensive approach to assess urban form interventions through natural experiments', *BMC Public Health*, vol. 19, no. 1, doi:10.1186/s12889-018-6339-z

[9] Stephen J. Mooney, Kate Hosford, Bill Howe, An Yan, Meghan Winters, Alon Bassok & Jana A. Hirsch 2019, 'Freedom from the station: Spatial equity in access to dockless bike share', *Journal of Transport Geography*, vol. 74, pp. 91–96, doi:10.1016/j.jtrangeo.2018.11.009

[10] Lief Pagalan, Celeste Bickford, Whitney Weikum, Bruce Lanphear, Michael Brauer, Nancy Lanphear, Gillian E. Hanley, Tim F. Oberlander & Meghan Winters 2019, 'Association of Prenatal Exposure to Air Pollution With Autism Spectrum Disorder', *JAMA Pediatrics*, vol. 173, no. 1, pp. 86, doi:10.1001/jamapediatrics.2018.3101

[11] Stephanie Sersli, Nicholas Scott & Meghan Winters 2019, 'Effectiveness of a bicycle skills training intervention on increasing bicycling and confidence: A longitudinal quasi-experimental study', *Journal of Transport & Health*, vol. 14, pp. 100577, doi:10.1016/j.jth.2019.100577

[12] Stephanie Sersli, Danielle DeVries, Maya Gislason, Nicholas Scott & Meghan Winters 2019, 'Changes in bicycling frequency in children and adults after bicycle skills training: A scoping review', *Transportation Research Part A: Policy and Practice*, vol. 123, pp. 170–187, doi:10.1016/j.tra.2018.07.012

[13] Stephanie Sersli, Linda Rothman & Meghan Winters 2019, 'Getting at Mode Share: Comparing 3 Methods of Travel Mode Measurement for School Travel Research', *Journal of School Health*, vol. 89, no. 5, pp. 365–372, doi:10.1111/josh.12743

[14] * Calvin Thigpen, Jaimy Fischer, Trisalyn Nelson, Suzanne Therrien, Daniel Fuller, Lise Gauvin & Meghan Winters 2019, 'Who is ready to bicycle? Categorizing and mapping bicyclists with behavior change concepts', *Transport Policy*, vol. 82, pp. 11–17, doi:10.1016/j.tranpol.2019.07.011

[15] * Meghan Winters, Kate Hosford & Sana Javaheri 2019, 'Who are the 'super-users' of public bike share? An analysis of public bike share members in Vancouver, BC', *Preventive Medicine Reports*, vol. 15, pp. 100946, doi:10.1016/j.pmedr.2019.100946

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F20. Is the participant applying for Teaching Relief?

(This is a 'Yes' or 'No' question.
(This question must be answered if the participant is a Chief Investigator)
• If you select 'Yes' you will be prompted to request the percentage of Teaching Relief for each requested year (25, 50, 75 or 100 per cent).
• The percentage of Teaching Relief will be automatically calculated and the request will be generated in the Form Part E.
• Note: CIs may request funding for teaching relief or other duties in order to maximise the opportunity for the CI to conduct research. This question is only relevant for CIs and will not be activated for PIs.
)

Certification

Certification by the Deputy/Pro Vice-Chancellor (Research) or their delegate or equivalent in the Administering Organisation

I certify that—

- I have read, understood and complied with the *Grant Guidelines for the Discovery Program (2019 edition)*, (grant guidelines) and, to the best of my knowledge all details provided in this application form and in any supporting documentation are true and complete in accordance with the grant guidelines.
- Proper enquiries have been made and I am satisfied that the participants and the organisations listed in this application meet the requirements specified in the grant guidelines.
- The ARC reserves the right to audit any evidence on which an application is based.
- I will notify the ARC if there are changes to any named participant or organisation after the submission of this application.
- The listed participants are responsible for the authorship and intellectual content of this application, and has appropriately cited sources and acknowledged significant contributions to this application.
- To the best of my knowledge, all Conflicts of Interest relating to parties involved in or associated with this application have been disclosed to the Administering Organisation, and, if the application is successful, I agree to manage all Conflicts of Interest relating to this application in accordance with the *Australian Code for the Responsible Conduct of Research (2018)*, the *ARC Conflict of Interest and Confidentiality Policy* located on the ARC website and any relevant successor documents.
- I have obtained the agreement, attested to by written evidence, of all the relevant persons and organisations necessary to allow the project to proceed. This written evidence has been retained and will be provided to the ARC if requested.
- This application complies with the eligible research requirements set out in the ARC Medical Research Policy, located on the ARC website.
- This application does not request funding for the same research activities, infrastructure or project previously funded or currently being funded through any other Commonwealth funding.
- If this application is successful, I am prepared to have the project carried out as set out in this application and agree to abide by the terms and conditions of the grant guidelines and the relevant Commonwealth grant agreement.
- The project can be accommodated within the general facilities of this organisation and if applicable, within the facilities of other relevant organisations specified in this application and sufficient working and office space is available for any proposed additional staff.
- All funds for this project will only be spent for the purpose for which they are provided.
- The project will not be permitted to commence until there is an ethics plan in place to ensure that the appropriate clearances or other statutory requirements will be met before the part/s of the project that require those clearances commence.
- I consent, on behalf of all the parties, to this application being referred to third parties, including to overseas parties, who will remain anonymous, for assessment purposes.
- I consent, on behalf of all the parties, to this application being provided to third parties for the purposes of assessment for potential other funding opportunities.
- I consent, on behalf of all the parties, to the ARC copying, modifying and otherwise dealing with information contained in this application.
- To the best of my knowledge, the Privacy Notice appearing at the top of this form has been drawn to the attention of all the participants whose personal details have been provided in the Participant section of the application.