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Profile

I am recognised as a problem solver and opportunity developer. Career milestones culminating in my doctorate, as well as my subsequent research endeavours have established a firm identity in which optimisation and decision support sciences are ingrained. Be it logical and intertwined business processes on paper; interactive computer simulation models; or notation-bombarded stochastic programs, the models are known to be reliable and accurate representations of the problems in reality.

Being a strong learner, combined with both responsibility and self-assurance as strengths, allows me to find suitable and reliable solutions to challenging problems. My exposure to leading research environments required me to pursue truly state-of-the-art solutions when required; but also equipped me with the ability to identify when intuitive and plausible solutions may be more appropriate than its complex and scientific counterparts. If a solution is to be implemented, its stakeholders should at least understand it. In this regard I am known to articulate and explain difficult concepts very well, in an elegant and professional manner.

I currently hold a C2-rating (Established researcher) from the National Research Foundation, South Africa. As a researcher I accumulated the relational skills to attract and develop leading minds, many of whom have consistently achieved accolades in both industry and academia. I am inspired by and learn much from my mentors, but more so by those that entrust me as their mentor — I truly believe that if I do my job well, those that I've taught will surpass me. Humbling? Hopefully. Invigorating? Definitely.

Research statement

Good research is anticipating the challenges that industry and government will face in five to ten years' time, and starting to work on those solutions *now* so they are mature and market-ready when needed.

With increased urbanisation and the challenges of socioeconomic diversity comes the challenge of moving people and goods so that citizens can participate productively in the economy. Effective transport infrastructure, indeed, is a critical component of economic productivity. The economic inequality and spatial challenges resulting from South Africa's political past became fertile ground for innovative solutions. My research agenda over the past few years was to challenge the state of practice of how transport modelling was used to support infrastructure investment and policy evaluation. While collaborating with research leaders in Europe, I played a pioneering role in introducing the state of the art in agent-based modelling into the South African transport planning fraternity. Coming from an Industrial and Systems Engineering background gave me an advantage in viewing transport models more holistically, and from a systems perspective. We consider the integrated movement of both goods and people equally important, and pushed the research frontiers in developing state of the art, multimodal transport planning models. Consequently I have had the privilege to collaborate and publish

leading journal articles with colleagues from a variety of backgrounds, including Engineering, Physics, Anthropology, Fine Arts, Geography, Environmental, and Computer Sciences.

We rely on models to evaluate the impact decisions and policies will have on real systems. Good models have two main qualities: a) they are accurate imitations of the realities they represent; and b) they must lead to improved decision-making. I consider myself a good translator between reality and the modelling domains. To perform the translation, I have honed skills in a number of tools including simulation modelling and optimisation. Within simulation I have extensive experience in agent-based, discrete event, and system dynamics modelling.

Work Experience

2016–2017	Perform freight network modelling and modal choice analysis, using Bayesian Networks, as part of the World Bank's Urbanisation Review for National Treasury's *Cities Support Programme* (CSP).
2014–2015	Developing driver risk profiles from vehicle telemetry devices. Collaboration project with industry partner.
2014–2015	Development of an agent-based transport model of commercial vehicles to provide decision support for the City of Cape Town's Freight Strategy.
2013–2014	Evaluation of the drivers of taxi inflation in South Africa for National Treasury. Measuring the transport supply and transport demand costs of paratransit stakeholders.
2013–2014	Simulating the traffic impact and truck movement of coal handling and construction vehicles at the Kusile Power Station during its ramp-up phase.
2012–2014	Training and implementation of the Multi-Agent Transport Simulation (MATSim) toolkit for the Gauteng Integrated Transport Modelling Centre, a project lead by the Council for Scientific and Industrial Research (CSIR).
2011–2013	Development of comprehensive agent-based mobility modelling tools for National Treasury. Establishing basic implementations of the Multi-Agent Transport Simulation (MATSim) models for eight South African cities and metropoles.
2011–2013	GFIP: Monitor driver impacts and model improvement. Considering changes in driving patterns pre and post-introduction of open-road tolling in Gauteng, South Africa. Project for the South African National Roads Agency Limited (SANRAL).
2010–2012	Transport and mobility modelling for the Council of Scientific and Industrial Research (CSIR) project on *Integrated Planning and Development Modelling* (IPDM), developing a decision support platform for the complex transport and land-use interactions.
2010–2011	Road pricing evaluation for the South African National Roads Agency Limited (SANRAL) using agent-based transport simulation for the Gauteng Freeway Improvement Project (GFIP).
2007–2011	CSIR Built Environment. Contract Researcher with *Advanced Modelling and Supply Chain Research* group.
2007	Business process modelling and redesign of the document handling facilities in the financial industry. The objective of the study was to identify opportunities to centralise handling such as cash, cheques, security documents, and other banking *physicals*.

2005 Logistics design project for the Department of Health, Eastern Cape. Establishing fleet structure, vehicle routing models and a balanced load schedule for the Livingstone Laundry.

2003–2004 Council for Scientific and Industrial Research. Contract Researcher with *Centre for Logistics and Decision Support*.

2003 Simulation study on the bulk and bag handling facilities at the Holcim Cement's Brakpan facility. The purpose of the study was to improve turn-around time of bulk vehicles loading specialised mixed product, and evaluating capital investment in bulk product storage.

2002 Simulation study on the production, scheduling, material handling, and logistics flow of a cement mixing and packaging plant at Alpha Cement, Roodepoort. The purpose of the study was to increase packaging capacity, and evaluate capital investment in an additional vehicle weigh-bridge to reduce turn-around times for vehicles.

2001 Process design, equipment evaluation for a high-specification chemical facility preparing pigments.

2001 Facility design and material handling evaluation for a mining and carbon processing plant.

2000–2001 Business process design for the banking industry. Worked on the implementation team for the launch of the first debt consolidation product with a transactional (credit card) functionality for Origin Merchant Bank (Now known as RMB Private Bank). Functional focus areas included back-end risk evaluation processes, credit card transaction handling, and call center processes.

2000 Facility design for small semi-automatic bottling plant.

1999–2000 Rimola Manufacturing, Operations Manager of a mineral water bottling plant. Business process design and implementation to adhere to strict beverage handling regulations and standards.

1998–1999 Sunburst Beverages cc, Project and Design Engineer on the construction and commissioning of a mineral water bottling plant. Design of original plant entailed raw material handling, production equipment evaluation, facility layout, inventory movement and storage, and detailed product handling infrastructure. The latter refers to filtration systems, tanks, mixers, and batching equipment. Business process design to adhere to strict beverage handling regulations and standards.

Academic Experience

since 2001 University of Pretoria. Currently appointed as Full Professor in the Department of Industrial and Systems Engineering.

Teaching emphasis on *Operations Research*, both at undergraduate and graduate level. I've established and is currently leading the *Optimisation Group* with a research emphasis on developing state-of-the-art decision support solutions for industry and government. The identity of the group is the ability to extract useful and reliable models from real problems and/or opportunities, and develop solutions accordingly.

Courses presented:

BAN 313 *Industrial Analysis*, 3rd year undergraduate. Co-developed. University of Pretoria, South Africa.

BUY 321 *Simulation Modelling*, 3^{rd} year undergraduate. Self developed. University of Pretoria, South Africa.

BUY 780 *Simulation Modelling*, Honours degree. Self developed. University of Pretoria, South Africa.

BOZ 311/321/312 *Operations Research*, 3^{rd} year undergraduate. Self developed. University of Pretoria, South Africa.

BOZ 780 *Operations Research*, Honours degree. Self developed. University of Pretoria, South Africa.

BAN 780 *Industrial Analysis*, Honours degree. Co-developed & co-presented. University of Pretoria, South Africa.

BVK 780 *Supply Chain Design*, Honours degree. Lecturer in *Network design* section and internal examiner. University of Pretoria, South Africa.

BES 220 *Engineering statistics*, assisting in 2^{nd} year undergraduate. University of Pretoria, South Africa.

POM *Resource Optimization*, Program in Operations Management, co-developed for the Continuous Education at the University of Pretoria (*CE@UP*)

2012 Institute for Transport Studies, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria. Visiting Professor.

Courses presented:

856306 *Traffic and Transport Planning*, beginners course in transport modelling. Self developed.

856049 *Traffic and Transport Planning*, advanced course in agent-based transport modelling. Adapted from the Multi-Agent Transport Simulation (MATSim) tutorials.

2011 Fellow of the *Mobility Cultures in Megacities* program, hosted by the Technical University of Munich, and the *Institute for Mobility Research* (ifmo), a research facility of the BMW Group.

2009 Institute for Transport Planning and Systems, Swiss Federal Institute of Technology Zurich, Switzerland. Visiting Professor.

The objective was to infer logistic activities from a large GPS data set and extract vehicle activities and activity chains. Once chain characteristics are known, they are modelled in a large-scale agent-based transport simulator. The model, implemented for the whole of Gauteng (South Africa), is a state-of-the-art decision support tool to evaluate government interventions in transport infrastructure, and assist in policy formulation. Since the technology relies on behavioural descriptors of vehicles and commuters, a realistic and plausible traffic response is achieved.

Courses presented:

101-0480-01L *Transport Optimization under Uncertainty*, Post-graduate course. Self developed. ETH Zürich, Switzerland.

Academic Qualifications

2007 — Ph.D (Engineering) at the University of Pretoria, South Africa.

Thesis: *An intelligent and integrated metaheuristic for constrained vehicle routing*. Supervisor: Prof. S.J. Claasen; Co-supervisor: Prof. V.S.S. Yadavalli.

Instead of twisting and tweaking an algorithm to perform at its best in a limited set of environments, the objective of this thesis was to develop an *intelligent* decision support algorithm that can be implemented in a variety of logistics settings. The algorithm has mechanisms to *sense* the problem environment, and adjust itself by changing parameters to fit better (finds more reliable solutions faster) to the problem environment. The algorithm incorporated *learning* so that memory is built over time, and although convergence is achieved, sudden changes in a problem environment invokes a heightened sense of learning. Optimisation algorithms are notoriously problem-specific. Hence, a self-regulating algorithm is useful since you don't want to redesign the wheel in every logistics application, but rather have the algorithm adjust (react) to the given problem.

2004 — Postgraduate Certificate in Higher Education (PGCHE) at the Faculty of Education, University of Pretoria, South Africa. Degree awarded with distinction.

My objective with pursuing this degree was to learn how to not just be a better scholar myself, but facilitate learning in those that are entrusted to me, either as graduate and post-graduate students, or in a continuous professional development context.

2003 — MEng (Industrial Engineering) at the University of Pretoria, South Africa.

Dissertation: *An initial solution heuristic for the vehicle routing and scheduling problem*. Supervisor: Prof. S.J. Claasen. Degree awarded with distinction.

Often in complex optimisation problems the first objective is to get a *good enough* and feasible solution to the problem. Especially since common sense practice often yields very good solutions, I am interested in duplicating and capturing the tacit knowledge of experts into explicit decision support algorithms. One could then apply brute force computational muscle to attempt to improve on expert opinion, and free experts to focus on new challenges in their business.

2001 — Programme in Financial Management for Non-Financial Managers, University of Pretoria, South Africa.

2001 — BEng(Hons)(Industrial Engineering) at the University of Pretoria, South Africa. Degree awarded with distinction.

1998 — BEng (Industrial Engineering) at the University of Pretoria, South Africa.

Research outputs

Publications in refereed journals

Gerber, J.-M., Joubert, J.W. (2022). Impact of road grade on the risk profile of driver behavior. *Transportation Research Record*, **forthcoming**, 1–11. DOI: 10.1177/03611981221089939.

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Hitge, G., Joubert, J.W. (2021). A nodal approach for estimating potential cycling demand. *Journal of Transport Geography*, **90**, 102943. DOI: 10.1016/j.jtrangeo.2020.102943.

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Viljoen, N.M., Joubert, J.W. (2019). Supply chain micro-communities in urban areas. *Journal of Transport Geography*, **74**, 211–222. DOI: 10.1016/j.jtrangeo.2018.11.011.

Brown, P., RELISH Consortium, Zhou, Y. (2019). Large expert-curated database for benchmarking document similarity detection in biomedical literature search. *Database*, **2019**, article ID baz085. DOIL 10.1093/database/baz085.

Bean, W.L., Joubert, J.W. (2018). A systematic evaluation of freight carrier response to receiver re-ordering behaviour. *Computers & Industrial Engineering*, **124**, 207–219. DOI: 10.1016/j.cie.2018.07.030.

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Willemse, E.J., Joubert, J.W. (2016). Benchmark dataset for undirected and Mixed Capacitated Arc Routing Problems under Time restrictions with Intermediate Facilities. *Data in Brief*, **8**, 972–977. DOI: 10.1016/j.dib.2016.06.067.

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Bean, W.L., Joubert, J.W. (2010). *Inventory management under uncertainty — An application*. Operations Research of South Africa (ORSSA) Conference, 26–29 September, Magoebaskloof, South Africa.

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Croucamp, J.M., Joubert, J.W. (2006). *Public transport network optimisation: An evolutionary approach*. 35th Operations Research Society of South Africa Annual Conference, 4–6 September 2006, Pietermaritzburg, South Africa.

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Cronjé, E.J., Joubert, J.W. (2005). *Optimisation of an empty container relocation network: A case study at TrenStar SA (Pty) Ltd*, 19th Southern African Institute for Industrial Engineering & 35th Operations Research Society of South Africa Annual Conference — Building towards Growth and Sustainability in SA, 28–31 August 2005, Vanderbijlpark, South Africa.

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Ncube, O., Luhandjula, M.K., Joubert, J.W. (2005). *A fuzzy stochastic multi-objective linear program formulation of a portfolio selection problem*, 19th Southern African Institute for Industrial Engineering & 35th Operations Research Society of South Africa Annual Conference — Building towards Growth and Sustainability in SA, 28–31 August 2005, Vanderbijlpark, South Africa.

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Yadavalli, V.S.S., Joubert, J.W. (2002). *A stochastic model of a two-product single period inventory system*, 17^{th} Annual conference of the Southern African Institute for Industrial Engineering (SAIIE), 18–20 September 2002, Stellenbosch, South Africa.

Public data sets

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Joubert, J.W. (2021). *Real driving emissions data: University of Pretoria*, Mendeley Data, v4.
DOI: 10.17632/y9pjtt5ngc.

Joubert, J.W. (2018). *Synthetic populations of South African urban areas*, Mendeley Data, v2.
DOI: 10.17632/dh4gcm7ckb.

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Former supervision of research students

2022	R.J. Gräbe; M.Eng (Industrial Engineering) Dissertation title: *Emissions in Gauteng*. Degree awarded with distinction.

2021 J. Gerber; M.Eng (Industrial Engineering)
Dissertation title: *Appending GPS traces with road grade data to estimate driver behaviour risk*. Degree awarded with distinction.

2020 D.J. Kotze; M.Eng (Industrial Engineering)
Dissertation title: *Solving the buffer allocation problem using simulation-based optimisation*. Degree awarded with distinction.

2020 M. van der Laarse; M.Eng (Industrial Engineering)
Dissertation title: *Modelling rhino presence with Bayesian networks*. Degree awarded with distinction.

2019 W.L. Bean; PhD (Industrial Engineering)
Thesis title: *Behavioural modelling of carrier and receiver collaboration in an agent-based urban transport simulation*.

2019 J.B. Vosloo; M.Eng (Industrial Engineering)
Dissertation title: *Development of a map-matching algorithm for dynamic-sampling-rate GPS signals to determine vehicle routes on a MATSim network*.

2019 J.S. Rees; MIT (Big Data Science); Co-supervisor
Mini-dessertation title: *Using complex network theory to analyse routing activities in workflow processes*.

2018 N.M. Viljoen; PhD (Industrial Engineering)
Thesis title: *Quantifying supply chain vulnerability using a multilayered complex network perspective*.

2018 H.D. Gildenhuys; M.Sc (Environmental Ecology); Co-supervisor
Mini-dissertation title: *The utility of linear programming for the conservation prioritisation of wetlands in Midrand, South Africa*. Degree awarded with distinction.

2017 W.C. Grobler; PhD (Industrial Systems)
Thesis title: *Investigating net ideal cycle time estimation and efficient buffer allocation for Body-in-White production lines*.

2016 E.J. Willemse; PhD (Industrial Engineering)
Thesis title: *Heuristics for large-scale Capacitated Arc Routing Problems on mixed networks*.

2016 M.D. Budeba; PhD (Mining Engineering); Co-supervisor
Thesis title: *Competitiveness and performance prediction of surface mining*.

2016 S. Meintjes; M.Eng (Industrial Engineering)
Dissertation title: *Analysing network motifs in a complex network of freight movements*. Degree awarded with distinction.

2015 Q. van Heerden; M.Eng (Industrial Engineering)
Dissertation title: *Modelling an agent-based commercial vehicle transport system: a supply chain perspective*.

2011 W.L. Bean; M.Eng (Industrial Engineering)
Dissertation title: *Inventory management under uncertainty: A military application*. Degree awarded with distinction.

2010 J. van der Merwe; M.Eng (Industrial Engineering)
Dissertation title: *Agent-based transport demand modelling for the South African commuter environment*.

2009	P.J. Fourie; M.Eng (Industrial Engineering) Dissertation title: *An initial implementation of a Multi-Agent Transport simulator for South Africa*. Degree awarded with distinction.
2008	M. Fletterman; M.Sc (Applied Science) Dissertation title: *Designing multimodal public transport networks using metaheuristics*. Degree awarded with distinction.
2007	D.G. Conradie; M.Eng (Industrial Engineering) Dissertation title: *Scheduling coal handling processes using metaheuristics*. Degree awarded with distinction.

Professional affiliations

Membership

ECSA	*Engineering Council of South Africa*. Professional Engineer (20030295).
SAIIE	*Southern African Institute for Industrial Engineering*. Member.
ORSSA	*Operations Research Society of South Africa*. Member.

Management and administrative duties

since 2019	Editorial board, *Transport Reviews*, ranked 1st in category *Transportation*, Impact factor (2020) 9.643.
since 2019	National Research Panel & project leader, *South African National Roads Agency Limited* (SANRAL).
since 2018	Programme Committee member: Ambient Systems, Networks and Technologies (ANT) committee on *Modeling and Simulation in Transportation Sciences*.
since 2017	Programme Committee member: Agent-based mobility, traffic and transportation models, methodologies and applications (ABMTRANS).
since 2013	Director: Institute for City Logistics.
since 2013	Committee member: Multi-Agent Transport Simulation (MATSim).
since 2007	Research group leader: Optimisation Group, Industrial and Systems Engineering, University of Pretoria.
2007–2008	Operations Research Society of South Africa (ORSSA) — Executive Committee member.
2006–2007	Southern African Institute of Industrial Engineering (SAIIE) — Council member.
2005–2009	Member of International Scientific Advisory Committee, *International Conference on Urban Transport and the Environment in the* 21st *Century*, Wessex Institute of Technology, Southampton, UK.
2005	THRIP Project leader, *Primary transport optimisation for the Fast Moving Consumer Goods (FMCG) industry*.
2005	Coordinator of the Programme Committee, and Secretary of the Organising Committee for the *SAIIE 2004 Annual Conference*.

2004-2005 Southern African Institute of Industrial Engineering (SAIIE) — Secretary of the Gauteng Branch.

Awards and recognition

2021 University of Pretoria, Faculty of Engineering, Built Environment and Information Technology, *Department of Industrial & Systems Engineering Teaching and Learning Award*.

2019 Best paper award: Bean, W.L. & Joubert, J.W., *'Modelling receiver logistics behaviour'*, at the *8th International Workshop on Agent-based Mobility, Traffic and Transport Models* (ABMTRANS), Leuven, Belgium.

2018 Southern African Institute for Industrial Engineering (SAIIE) award for *Most outstanding Industrial Engineering Researcher*.

2013 South African Institution of Civil Engineering (SAICE) Transportation Engineering Division commendation for the paper delivered: *"Using multi-source GPS data to characterize multiday driving patterns and fuel use in a large city region"*, Transportation Research Record No 2338, Washington DC.

2007 Southern African Institute for Industrial Engineering (SAIIE) President's Award for outstanding service to the members and Council of SAIIE and the profession of Industrial Engineering.

Interests

Cycling I've participated in a number of long-distance (more than 80km) road races; slowly improving my times. Best times include 3:15'27" for the Telkom 94.7 Cycle Challenge (95km), and a 3:26'41" for the Cape Town Cycle Tour (Argus) (109km).

In more quantitative terms it means I usually end up in the first quartile of the two largest timed cycling events in the world based on my overall position, gender and age group. I don't consider it a race against the clock but rather, in the words of a wise mentor of mine, a celebration of ability. I can, so why not just give it a shot.

Hiking I have a real appreciation for nature, not so much the *big five*, but rather the incredible sense of solitude and peace that you experience in so many different parts of my beautiful homeland, South Africa. Although some may not want to refer to it as a true *mountain*, the Magaliesberg is very close to my heart, especially Tonquani, Groot Kloof, Retiefskloof and Dome Pools, where you find some of the most beautiful gorges and rock formations.

The *Drakensberg* is much too wide a term with too much diversity. I am invigorated to share time with close friends and family navigating our way around the Central Berg and find elusive caves. They are not so much hidden, than your body's yearning to stop pressing on once you've reached the escarpment. My favourite hide-outs are the Upper Injasuti and the Ndumeni caves.

Referrals

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