Geotechnical and Transport Engineering Research Topics 2024

Supervisor(s)	Degree	Preliminary title of research project	Brief description of project	Scholarship per year
Peter Day	M Eng S/R	Comparison of LSD and RBD methods for cohesive soils	Determine Eurocode compliant solutions for 7 design situations for undrained clays (c = cu and ϕ = 0) followed by a determination of the reliability index using FORM and the factor of safety.	
Charles MacRobert	M Eng S/R	Back analysis of credible tailings storage facility failure mechanisms	Back analysis of actual failures and incidents of tailings storage facilities using limit equilibrium and finite element limit analysis.	
Charles MacRobert	M Eng S/R	Digitially assisted testpit logging	Development of a generative test pit logging algorithm and interpretation algorithim.	
Charles MacRobert	M Eng S/R	Framing of Tailings Storage Facility Failures	Descriptive and interpretive study of the history surrounding the response of the South African mining industry to the Aberfan (1966), Bafokeng (1974), Merriespruit (1994) and Jagersfontein (2022) tailings dam failures.	
Charles MacRobert	M Eng S/R	Back analysis of natural slope failures.	Back analysis of slope failures using limit equilibrium and finite element limit analysis.	
Dr Elaine Goosen (co-supervision with Mech Eng)	MEng(R)	Back calculation of rail ballast stiffness from deflection measurements	This project will be co-supervised by the Gibela research group. Sensors will be installed at points along the railway track. The deflection measurements must be applied to estimate the stiffness of the ballast and other pavement layers.	Funding option available
Dr Elaine Goosen	MEng(R) / PhD	Performance Testing of Asphalt Containing Lignin	Lignin is one of the most prevalent fibres on the planet. Previous research has shown that it has the potential to act as a bitumen replacement. The largest inhibitor to acceptance in industry is the lack of durability and performance testing. This project will run adjacent to an MEng(R) in Chemical Engineering regarding the extraction of water-insoluble lignin, by preparing asphalt briquettes and completing accelerated pavement testing.	Speak to lecturer for funding options
Dr Elaine Goosen	MEng(R) / PhD	Life cycle cost analysis of various pavement engineering structures	Many reclaimed and recycled materials have been introduced into pavement engineering materials in recent years. The goal of this project will be to select prevalent pavement structures and compare the long term contributions to carbon emission reductions.	Speak to lecturer for funding options
Dr Elaine Goosen	MEng(R) / PhD	Unconventional alternatives to improve the quality of unsuitable and marginal materials in pavement engineering	One of the most expensive aspects of road-building is the earthworks component. Substandard material that must be spoiled contribute immensely to this expense due to the costs of fuel. This project will have the freedom to identify unconventional additives, reclaimed or recycled materials to improve the performance of marginal or unsuitable material to reduce wastage and related expenditure.	Speak to lecturer for funding options
Dr Elaine Goosen	MEng(R) / PhD	Applying pyrolyzed coffee grounds as sand replacements in pavement engineering	Recent research had indicated that the use of biochar as a sand replacement in concrete may increase its stiffness. Sand as a road construction material is at times scarce and impact the mix design of specific materials. The project will investigate whether pyrolyzed coffee grounds can act as a suitable sand replacement in pavement materials.	Speak to lecturer for funding options
Dr Elaine Goosen	MEng(S) / MEng(R) / PhD	Machine learning applications in pavement engineering	Machine learning (ML) is becoming a common analytical tool for engineers. This research project will investigate additional insights ML can offer regarding pavement material behaviour and engineering. Examples include, but are not limited to, road condition indices form satellite images, correlations in material properties and behaviour, analysis of time-related data, and predictive modelling. Experience in programming preferred.	Speak to lecturer for funding options
Dr Elaine Goosen and Prof Riaan Combrinck	MEng (R) / PhD	Using coated aggregates to improve the granular layer of roads	A granular sub-base is used to increase the load carrying capacity of roads. This layer is composed of a high quality aggregate with a specific grading. This study should investigate the mechanical and durability properties of this granular layer if the aggregates are coated with a thin layer of reactive cementitious material.	Speak to lecturer for funding options
Prof Johann Andersen	Various projects for MEng(R)	RESEARCH AREA: Planning needs and application areas of Autonomous and Connected vehicles in South Africa	Linked with SARNAL research proposal on AV/ CV planning for South Africa.	

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Prof Johann Andersen	Various projects for MEng[R]	**RESEARCH AREA:** Transport data visualisation	Data visualisation is an important step in making Big Data accessible and usable. Consider data processing for traffic data in South Africa, creating dashboard visulasations.	
Prof Marion SInclair	Various projects for MEng[R], MEng[S]; PhD	**RESEARCH AREA:** Road safety	**Subthemes include**: Safety effects of road design standards Safety of road users at night Pedestrian safety Area-based road safety evaluations and recommendations Public Transport – improvements in efficiency and safety (various modes) Speed limit implications for safety Vulnerable road users. Specific topics to be developed in consultation between student and supervisor.	
Prof Marion SInclair	Various projects for MEng[R], MEng[S]; PhD	**RESEARCH AREA**: Enhancing road users' experience	**Subthemes include**: Universal access and safety of road users Designing roads for people/ urban regeneration Promoting NMT Specific topics to be developed in consultation between student and supervisor.	
Prof Marion SInclair	Various projects for MEng[R], MEng[S]; PhD	**RESEARCH AREA**: Transport equity	**Subthemes include**: Road-based crime analysis and prevention; Security impacts on road safety; Impacts of road insecurity on road user behaviour. Specific topics to be developed in consultation between student and supervisor.	
Prof Marion SInclair	Various projects for MEng[R], MEng[S]; PhD	**RESEARCH AREA:** Road user security	**Subthemes include**: Road-based crime analysis and prevention; Security impacts on road safety; Impacts of road insecurity on road user behaviour. Specific topics to be developed in consultation between student and supervisor.	
Dr Megan Bruwer	Various projects for MEng[R], MEng[S]; PhD	**RESEARCH AREA:** The impact of the built environment on sustainable transport behaviour	Develop understanding of international urban form that encourages sustainable transport solutions, for example ride-sharing, public transport, off-peak travel, etc. and evaluate how this would translate to a South African context. Examples of research questions: - What steps should urban planners and transportation engineers take to promote urban form that encourages reduced private car usage and environmental impact of transport? - How could we reform our parking strategies to maximum parking standards rather than minimum parking requirements, and what impact would this have on urban form and transport behaviour?	
Dr Megan Bruwer	Various projects for MEng[R], MEng[S]; PhD	**RESEARCH AREA:** Application areas of Floating Car Data in an African context	More work is needed to identify areas of transport planning and traffic engineering that can be improved through the application of FCD. Projects could look at LOS analysis of roads and intersections using FCD, evaluation of queue lengths from FCD, congestion tracking, etc,	
Dr Megan Bruwer	MEng(R)	The feasability of a new rail services supporting Stellenbosch Unviersity students and staff	Stellenbosch traffic congestion is well known, and is impacted greatly by the high cost of housing in Stellenbosch, which forces many Stellenbosch University students and staff to live in surrounding urban areas. Evaluate the feasibility of operating a dedicated passenger train between Wellington, Paarl, Stellenbosch and Eerste River. As part of this research, the interaction of rail with supporting infrastructure such as feeder networks and park 'n ride facilities should also be investigated.	A funding proposal is underway which may provide financial support for this study.
Dr Megan Bruwer	MEng(R)	Universal accessibility of South African rail services	Evaluate the level of accessibility of South African urban rail systems for public transport users of diverse abilities and backgrounds. Universal design principles should be investigated throughout the Cape Town metropolitan rail system, with comparison to international standards. Suggestions for implementable solutions should be made.	
Dr Megan Bruwer	MEng(R)/(S)	Variation of traffic in holidays towns in South Africa	Traffic varies greatly throughout the year in sleepy coastal towns in South Africa. This has led to an oversupply of traffic capacity for the majority of the year, and significant traffic congestion during holiday periods when the population of these popular holiday destinations explodes. Evaluate typical montly traffic growth factors for coastal towns and recomment the optimal design flow, related to the well used 30th highest hourly traffic volume. Use Floating Car Data to assist in this analysis.	

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Dr Megan Bruwer	MEng(S)	AADT accuracy when evaluated from expansion factors	AADT is regularly estimated from a short-term traffic count and expansion factors determined elsewhere on the road network. Evaluate the accuracy of using expansion factors to estimate AADT, and suggest how long a coverage count should be to estimate a reasoable AADT with expansion factors.	
Dr Megan Bruwer	MEng(S)	Criteria for selecting expansion factors for AADT estimation	AADT is regularly estimated from a short-term traffic count and expansion factors determined elsewhere on the road network at a continuous count station. Evaluate a set of criteria from widely available Floating Car Data that can be used to select the a suitable continuous count station at which expansion factors can be generated, ensuring similar traffic patterns.	
Kim Jenkins, Prof	MEng (R)	Assessment of G5B unbound material performance using DCP-DN and CBR methods	SANRAL Research Project 3.5: Assessment of the Suitability of CBR and DCP-DN methods to support Triaxial Tests is necessary for verification of G5B/G6 material's performance	R 80 000
Kim Jenkins, Prof	MEng (R/S)	Mix Design Methods for Quality Control of BSM by Stacking Specimens	Bitumen Stabilised Materials require improved Quality Management methods. Stacking of BSM specimens to provide triaxial test methods for QC are promising and need expanded research	
Kim Jenkins, Prof	MEng (R/S)	Mix Design Methods for Evaluation of Reclaimed Asphalt RA Type and Content requires Optimisation of BSMs	Bitumen Stabilised Materials require improved evaluation of variable RA types and contents for application. A spectrum of RA binder ageing and application rates need to be investigated so that triaxial test methods can optimise BSM performance.	
Kim Jenkins, Prof	MEng (R)	Evaluation of discrepancy between HWTT and MMLS accelerated testing with Bitumen Rubber Asphalt	Bitumen Rubber Asphalt has different performance outcomes for with Hamburg Wheel Tracking Test and Model Mobile Load Simulator. Methods of vibration versus roller compaction also influence the BR response, however, investigation into the performance mechanism requires research.	
Kim Jenkins, Prof	MEng (R) /PhD	Balanced Mix Design of asphalt mixes requires	Balanced Mix Design deals with a mix design approach that enables a balance between rutting and cracking performance, as well as durability. This research focusses on specific mixes and test methods e.g SCB, MMLS, HWTT to attain improvements of mixes in southern Africa .	