

Digital, experimental and econometric initiatives contribute to an enabling transportation sector

The transportation sector is a key contributor to South Africa's competitiveness in global markets, and is regarded as a crucial engine for economic growth and social development. Researchers in the Department of Civil Engineering, in collaboration with colleagues in other departments at the University, are launching a multi-pronged initiative to ensure that the country's road infrastructure can compete with the best in the world.

The focus of the Department's research is on both the durability of the materials used in the construction of the road pavement, and the intelligent planning of the transportation infrastructure. By analysing the pavement structure on the basis of the type and quantity of traffic it is expected to carry in its lifetime, civil engineers are able to determine the best design for each class of road in the national and local road network.

However, the dynamics of the transportation industry entails more than just the carrying capacity and performance of the road pavement. The behavioural patterns of commuters and other road users have a major impact on traffic, and for this reason, strategic transportation planning has an indispensable role to play in developing an enabling transportation sector.

Pavement engineering

The Department's expertise in pavement engineering resides primarily in the specialised experience of Prof Wynand Steyn and Prof James Maina. Prof Steyn has a special interest in vehicle-pavement interaction, accelerated pavement testing and pavement materials and instrumentation. He spent 19 years with the Council for Scientific and Industrial Research (CSIR) in various

technical and managerial positions before joining the University. Prof Maina, who joined the University in October 2014, was a chief research engineer and leader of the Pavement Design and Construction Group at CSIR Built Environment. He spent close on ten years with the CSIR, of which 18 months were on a sabbatical in Qatar.

While at the CSIR, Prof Maina developed numerical modelling tools, system identification, software and parallel processing protocols focusing on pavement engineering applications. In Qatar, he was responsible for developing quality management systems for quality assurance and quality control in road design and construction projects in preparation for Qatar's hosting of the 2022 FIFA World Cup.

At UP, Prof Maina continues research in the same areas, while building the skills and capacity of students in the Department of Civil Engineering.

The work of the pavement engineering team focuses on both the physical qualities of the road pavement and modelling to predict the performance of a particular pavement type by using properties of the different materials that are used.

To support the experimental findings,

the University has recently started to make use of simulation-based research, which makes use of numerical tools to predict the performance of the road pavement. This process is expected to lead to very cost-effective pavement design solutions for South African roads.

Transportation engineering

Strategic transportation planning is of vital importance when it comes to accommodating the needs of commuters and other road users, and their impact on traffic.

The Department's expertise in this field resides in the experience of Prof Christo Venter. Prof Venter has an interest in transportation planning, land-use and transport interactions, travel behaviour research and modelling, and public transportation planning and operations.

According to Prof Venter, researchers at the University of Pretoria are investigating a number of related topics that will contribute to a better user experience in terms of road travel. These include the statistical analysis of travel data and the development of cost-effective modelling methods for transport planning in developing countries, as well as the use of new technologies in travel data collection, such as GPS data and crowdsourcing.



→ *A convoy of trucks transporting freight head south down the N1 highway, just outside Polokwane.
Photo: Graeme Williams, MediaClubSouthAfrica.com.*

Research has also been conducted on the interaction between transport systems and land use, social equity, quality of life and the economy. This includes aspects such as the impact of gated communities on travel and mobility, the impact of public transport innovation (like the deployment of the Bus Rapid Transit system) on urban poverty, and accessibility as a means of measuring the impact of transportation. A number of these research projects are conducted in the Centre of Transport Development.

Centre of Transport Development

The Centre of Transport Development is a collaborative research

entity in the School of Engineering that pursues multidisciplinary research in the areas of rail, pavement engineering, transport planning and operations, and mobility modelling.

The Centre was initially established with the support of the national Department of Transport, and several collaborative projects have been undertaken by researchers from the Department of Civil Engineering and the Department of Industrial and Systems Engineering.

Other departments that have also been included in research projects are the Department of Town and Regional Planning and the Department of Economics

in the Faculty of Economic and Management Sciences.

Prof Johan W Joubert of the Department of Industrial and Systems Engineering has a particular interest in the modelling, simulation and optimisation of transportation systems, and as such, has been involved in projects that make use of transport modelling to support infrastructure investment and policy evaluation.

According to Prof Joubert, the increasing digitisation of transportation systems opens up the potential of using GPS data, as well as data captured on the E-Toll gantries, to optimise transportation planning. Future research projects in the Centre of Transport

Development will be able to exploit this data-rich environment to analyse, monitor and manage movement on the roads by tracking the movement of vehicles and freight in order to anticipate the future needs of road users.

By means of simulation-based studies, the behaviour and movement patterns of private commuters, minibus taxis and freight vehicles can be anticipated and predictions made that will assist in the planning of road networks.

This research will make an important contribution to infrastructure development, while improving the flow of traffic. 📍