Expanding the view of road engineers in training

by Prof Wynand J van der Merwe Steyn

Road pavement engineers are traditionally trained with the emphasis on the materials and processes required to design, construct and maintain roads. The majority of their work focuses on the analysis of traffic loads on roads, the selection of adequate materials to carry these loads, and procedures to ensure that the roads will remain in a serviceable condition for their whole economic life. All of these activities are typically conducted on the assumption that the inputs from the traffic remain relatively constant over the life of the pavement, and with the emphasis on the economic cost of constructing and maintaining the infrastructure.

Although vehicle operating costs (VOCs) have traditionally been incorporated into detailed economic analyses, they were not seen as elements to which road engineers could necessarily make a major contribution. In recent years, the effect that road riding quality (or the unevenness on the surface of the road) has on the experiences of a vehicle (and specifically trucks) travelling on roads, and the contribution of these uneven surfaces to the damage caused to the vehicle and cargo, have been receiving increased attention internationally.

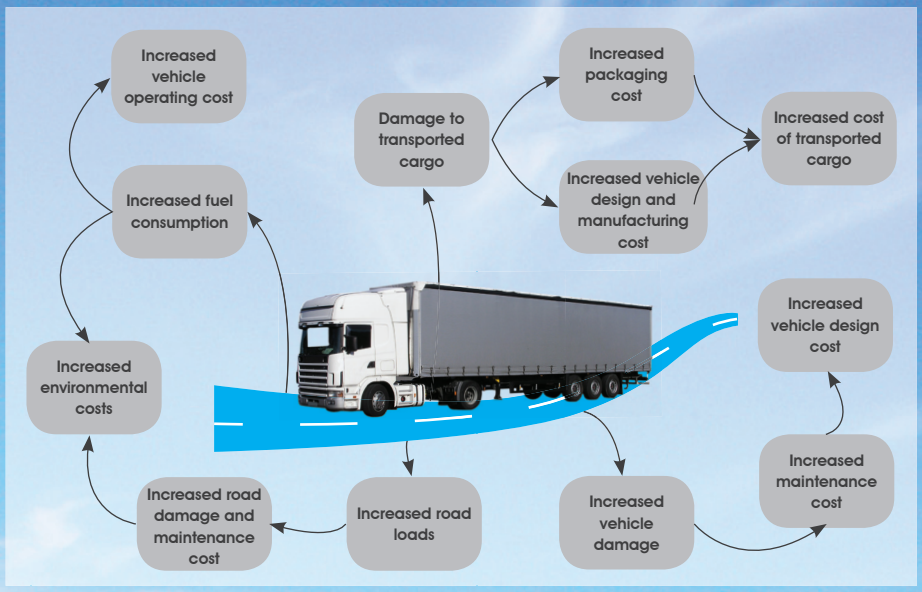
Research into this specific phenomenon is being conducted in a joint project between the University of Pretoria, the Council for Scientific and Industrial Research (CSIR) Built Environment and the University of California at Berkeley and Davis. CSIR Built Environment has, over the past six years, been involved in a state of logistics survey that was conducted to analyse quantitative logistics trends in South Africa and was aimed at informing and assisting public and private sector role-players and decision-makers who operate in the logistics and supply chain management environment. This was done with the support of Imperial Logistics and the University of Stellenbosch. Since 2008, the effects of the worsening riding quality of roads have been included in the survey, with a view to evaluating the ultimate effects of such riding quality on the broader economy.

The specific focus from the road engineering side was to evaluate how the riding quality of specific roads deteriorate over time (with usage by vehicles) and how this deterioration contributes to the damage experienced by the vehicles. The concept and potential effects are illustrated in Figure 1. Changes in the riding quality have a direct influence on a number of non-road-related engineering issues, such as damage to vehicles, damage to cargo, and, ultimately, issues such as the cost of packaging transported cargo. An evaluation of the vibrations caused by vehicles transporting perishable goods on roads has shown that specific locations on the vehicle are specifically prone to larger vibrations. If the riding quality of the road decreases below a certain threshold, improved packaging of perishable goods or improved vehicle components become essential. This adds to the cost of the ultimate product. Current calculations indicate average percentage increases of between 2.5% and 10% as the condition of roads deteriorates from a good to fair and good to bad riding quality.

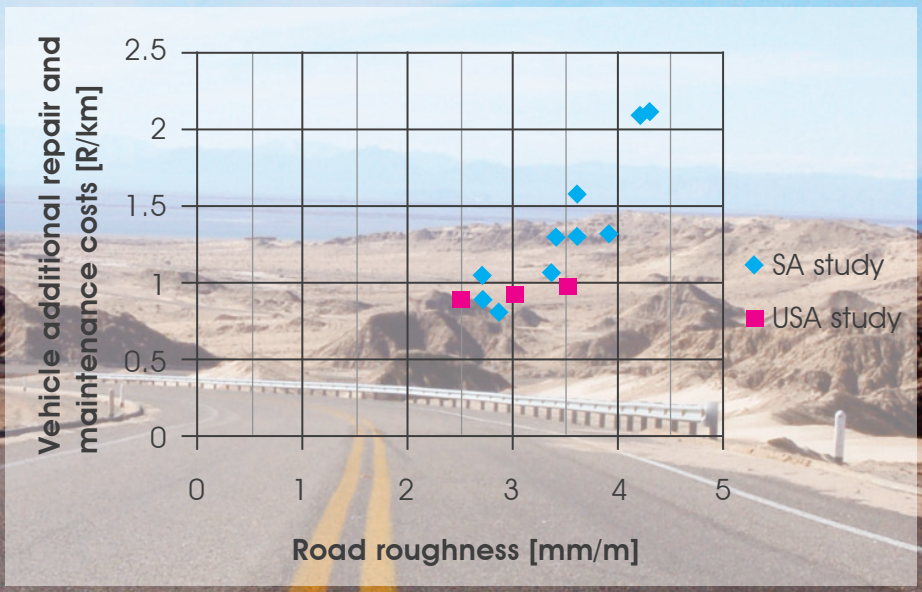
Current research focuses on the comparison between these increased costs and the required cost to perform adequate maintenance on the roads to ensure that they remain in a good ridable condition.

Figure 2 indicates data from a population of real vehicles collected while travelling over a number of roads over a period of six months. It shows the increase in vehicle damage costs due to decreases in riding quality. It also shows data obtained through a study conducted in the USA that compares the conditions in South Africa and the USA. The comparison indicates that similar damage rates are experienced in the two environments.

The information that was collected in these studies is now finding its way into the curriculum of the road engineers at both undergraduate and postgraduate level at the University of Pretoria. The focus of this is to illustrate the broad effect that decisions regarding road maintenance – and specifically, the lack of adequate maintenance – potentially have on the national economy.



→ *1. Conceptual effects of inadequate riding quality on the economy.*



→ *2. Measured vehicle maintenance and repair cost indicating an increase due to deteriorating riding quality.*

References

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