

Rural roads and agricultural cargo:

Enhancing the visibility of research

Rural roads characteristically carry relatively low volumes of traffic. In the typical national gross domestic product (GDP) context, their role is often not viewed as being of major economic importance. Rural roads are viewed more in terms of an accessibility provider than a mobility provider in the larger context of a country's transport infrastructure.

It is generally accepted that the importance of rural roads for local communities lies mainly in the provision of access to health and educational opportunities. Their economic role is typically, at best, seen as providing access for labourers to the labour markets in larger towns and cities.

However, in the major agricultural production areas of a country, the role of these rural roads is not only to provide access, but also to facilitate mobility in terms of the transportation of agricultural cargo to viable markets.

Riding quality

It is a well-known and appreciated fact that road condition affects the operations and costs of vehicles using the transportation infrastructure. Most vehicle operating cost (VOC) models provide an indication of road roughness effects on fuel consumption, and additional damage to vehicle and tyre wear.

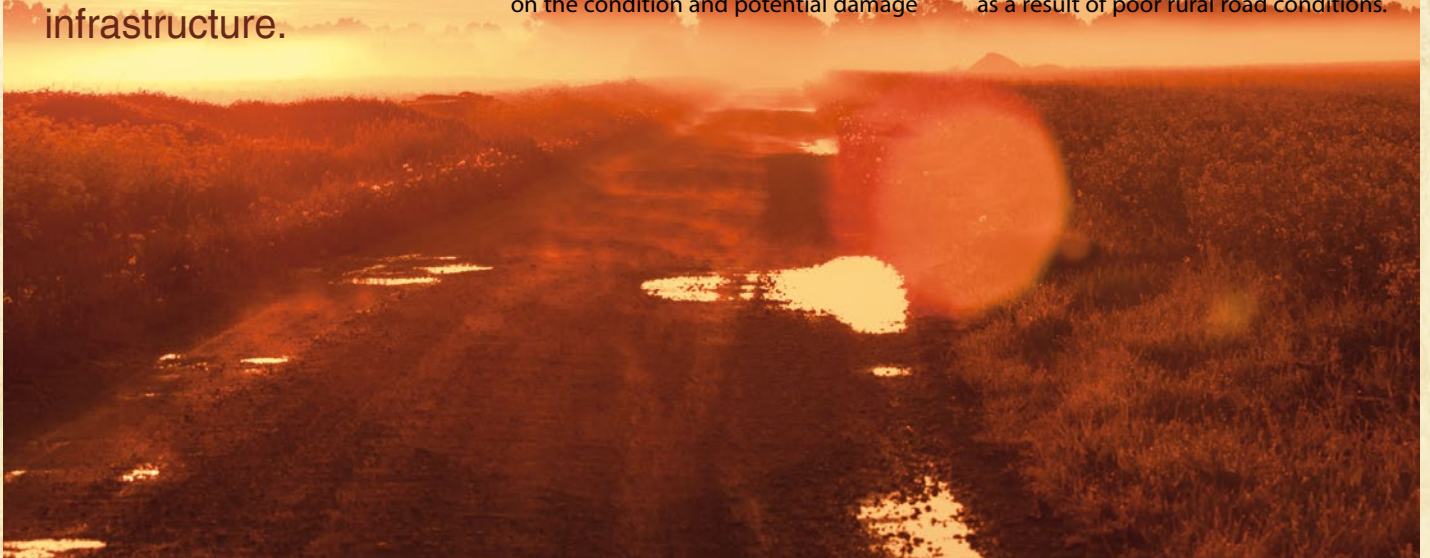
These models, however, typically do not include the effect of road conditions on the condition and potential damage

to the transported cargo. Riding quality of a road, defined as the smoothness of the ride experienced by a vehicle on a road, is used as the primary indication of its quality – mainly due to findings that most of the deterioration in the road structure ultimately translates into a decrease in riding quality.

Negative implications of poor rural roads beyond vehicle operating costs involves the following. In normal conditions, the protection of goods is mainly provided by the packaging used to transport the cargo. In the case of agricultural transport, packaging is often not a solution to the problem, as the use of older vehicles operated on mostly rural roads with lower riding quality levels is a main contributor to cargo damage.

Extending the assessment

A number of projects which investigated and quantified the effects of riding quality on low-volume roads on selected damage levels of tomatoes, revealed new insights into the issue of cargo damage as a result of poor rural road conditions.



In these studies, performed by the University of Pretoria, California Department of Transportation, University of California, Davis and others, vehicle and cargo responses to road conditions were measured during operations on a range of rural routes. Damage and failure levels for the tomatoes during transportation were determined, and these damage levels were used to calculate typical costs to the agricultural suppliers due to road conditions.

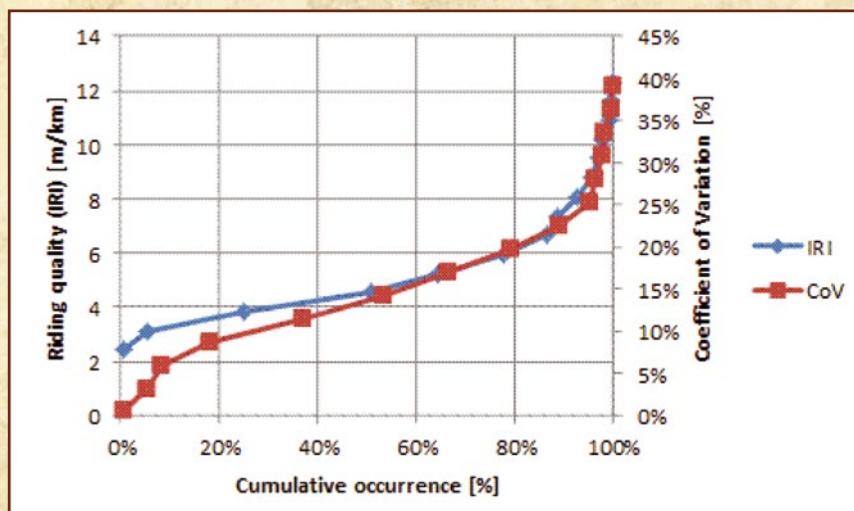
Various studies correlating the road riding quality and vibrations, accelerations and responses in vehicles and cargo have also been conducted. These studies mainly concluded that a decrease in the riding quality of a road is a major cause of increased vibrations and subsequent structural damage to vehicles and cargo. This leads to direct negative economic effects to the producer/farmer, such as increased transport costs, loss of market value of the transported cargo and reductions in revenue.

Coefficient of variation

A typical relationship between the road condition, expressed in terms of riding quality or international roughness index (IRI), and truck and cargo response, in terms of coefficient of variation (CoV) of vertical accelerations, is shown in *Figure 1*. It indicates the direct relationship in occurrence of increasing riding quality and truck and cargo response through the cumulative occurrence of these two factors measured on a rural road.

The relationship does not only focus on the riding quality and truck and cargo response, but also the time spent on the particular road – as longer trips would typically cause more damage to the cargo. Studies have shown that losses of up to 8% in income can be incurred due to tomatoes fetching lower prices (being damaged) or not being sold at all (failed), due to damage caused by transport over rough roads.

Figure 1: Cumulative occurrence of riding quality and CoV for rural routes.



The overall objective of the management of riding quality on rural agricultural access routes is to enable the road owner to manage the risks of decisions related to the management and preservation of the pavement network in an improved way, as the potential effects of such decisions will be quantifiable in economic terms.

Potential use of research results

The type of information collected from agricultural cargo road quality studies can assist road owners to develop (a set of) cargo performance measurement indicator(s): This may be a combination of the expected damage and failure of cargo on the routes for a specific county or region, combined with the lower speeds that trucks typically maintain on rougher routes to indicate the potential economic effects of the road network, of which the roughness is less than optimal.

The data can further be used to define and design policies on the provision and maintenance of agricultural routes by road owners and agencies, as the data provides for a quantifiable method to establish the additional cost of routes that are in an unacceptable condition. Road users can use these types of data to conduct an evaluation of the level of

maintenance costs that they can absorb through their own contributions, in order to ensure lower damage levels to their cargo.

Road condition affects the operations and costs of vehicles using the transportation infrastructure.

Lastly, knowledge of the levels of road condition that are most damaging to the cargo in a certain region, can lead to the development of a collection of road condition triggers and warning levels (in the Pavement Management System) which should alert the road owner in a timely manner of decreasing riding quality levels and a subsequent expected increase in cargo damage.

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