Degree of Vehicle Overloading and its Implication on Road Safety in Developing Countries

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Abstract
The phenomenon of vehicle overloading is not new and has been discussed in relation to the adverse effects on road pavement damage, road safety and GHG emission. Although much has been said in the context of the more developed countries, there has not been much discussion on vehicle overloading in developing countries. In this study, the extent and degree of vehicle overloading in a developing country is established. Half of the 3-axle trucks were found to be overloaded and the degree of overloading is up to 101% of its legal weight limit. The effect of truck overloading on safety is discussed by establishing the relationship between truck stopping distance and gross vehicle weight for a certain travel speed. Comparison between actual overloading data for 2-axle, 3-axle and 4-axle trucks and the stopping distance illustrates the gravity of the situation which needs a comprehensive and effective strategy from the relevant agencies.

Keywords: Road Safety, Vehicle Overloading, Traffic Accidents, Weigh-in-Motion, Stopping Distance

1. Introduction
It is important for those responsible for the maintenance and operation of highway infrastructures to monitor and prevent truck overloading. The additional weight carried by overloaded trucks accelerates the deterioration of the roadway, leading to rutting, fatigue cracking, and in certain cases structural failure (Sharma, 1995; CSIR, 1997; Ikhsan et al., 2003; Sardero et al., 2005). In a 1990 report (Transportation Research Board, 1990), illegally loaded trucks were estimated to cost United States taxpayers $160 to $670 million per year on the highway system. Straus and Semmens (2006) conducted a study to quantify state highway damage on the basis of the impacts of overweight vehicles. Each year, millions of dollars of damage associated with life span, design, and maintenance of state highways and structures are attributed to vehicles that exceed state weight limits. They found that for every dollar invested in motor carrier enforcement efforts, there would be $4.50 in pavement damage avoided. It is possible to develop a system that would increase the proportion of noncompliant vehicles subjected to inspection relative to compliant vehicles (Titus, 1996). The fact vehicle overloading causes road pavement structural distress and decrease in service life has also been reported by Mulyono et al. (2010) and an analysis of lost cost of road pavement distress due to overloading freight transportation was also presented. Podborodinskaia et al. (2011) quantified incremental pavement damage caused by overweight trucks in Saskatchewan, Canada and reported that accelerated damage from truck overloading has decreased the expected performance life of many of the roads and also increased maintenance and rehabilitation requirements and costs.

Campbell et al. (1988) evaluated crash types and found that a there is moderate increase in accidents rates for higher gross weights. Francher et al. (1989) later reported that the number of fatal truck crashes related to rearward amplification per mile traveled significantly increased as rearward amplification increased. This implies that, other things being equal, significant increases in gross vehicle weight (GVW) would increase the probabilities of the vehicle being involved in a fatal rearward amplification crash. Fatal involvement rates in rollover and ramp-related crashes also increased with increased GVWs. For curve related crashes and crashes in which trucks rear-ended other vehicles, increased GVWs may increase fatal involvement rates, although the