A re-parameterisation of the Power Model of the relationship between the speed of traffic and road safety

Rune Elvik

Institute of Transport Economics, Oslo, Norway and Lund University, Lund, Sweden

E-mail: re@toi.no

ABSTRACT

The Power Model of the relationship between the mean speed of traffic and road safety was originally proposed by the Swedish road safety researcher Göran Nilsson. Subsequent evaluations of the model, most recently in 2009, have broadly speaking supported it. However, the most recent evaluation of the model indicated that the exponents capturing the effects of changes in speed vary according to traffic environment and initial speed. These two characteristics are highly correlated, since the mean speed of traffic tends to be lower in urban areas than in rural areas. Studies indicate that the relationship between speed and road safety depends not only on the relative change in speed, as suggested by the Power Model, but also on initial speed. This implies that the exponent describing, for example, a 25 percent reduction in speed will not be the same when speed changes from 100 km/h to 75 km/h as it will when speed changes from 25km/h to 18.75 km/h. This paper reports an analysis leading to a re-parameterisation of the Power Model in terms of continuously varying exponents which are modelled as a function of initial speed. The re-parameterisation was accomplished by fitting exponential functions to data points in which changes in speed and accidents were sorted in groups of 10 km/h according to initial speed, starting with data points referring to the highest initials speeds. The exponential functions fitted the data extremely well and imply that the effect on accidents of a given relative change in speed is largest when initial speed is highest. This is consistent with the laws of physics as summarised in terms of the amount of kinetic energy produced by speed and the relationship between speed and stopping distance.