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Summary:

Speed and road safety – new models

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Speed is of major importance for road safety. It is therefore very useful to develop mathematical models of the relationship between speed and road safety. One of the best known of these models, the Power Model, has been used for a long time. Recently, however, an exponential model has also been developed for describing the relationship between speed and road safety. Both these models have been found to fit the data very well and both of them are sufficiently precise to be used for estimating the road safety effects of changes in the speed of traffic. The current report also reviews studies of the relationship between speed variance and road safety. These studies indicate that increased speed variance is associated with an increased risk of accidents.

Speed has major importance for road safety. This knowledge was established many years ago. This report updates knowledge about the relationship between speed and road safety. The report covers two characteristics of speed: the mean speed of traffic and speed variance.

The relationship between changes in the mean speed of traffic and changes in road safety has been studied in at least 120 studies containing in total at least 550 estimates of the relationship. The relationship between the speed of traffic and road safety has for a long time been modelled by means of the so called Power Model. Recently, however, an exponential model has also been proposed to describe the relationship between the mean speed of traffic and road safety. Both these models are based on extensive data.

Both models provide fairly precise descriptions of the relationship between mean speed and road safety. The models can therefore be applied to predict the effects of changes in mean speed on the number of accidents and on the number of killed or injured road users. The exponential model has certain mathematical properties that makes it better suited than the Power Model for estimating the effects of changes in speed that apply only to a certain share of the entire speed distribution, for example the effects on safety if the ten percent fastest drivers slow down.

It has long been believed that speed variance is also related to safety. Older studies of this relationship were not entirely conclusive. In the recent 15 years, however, the use of loop detector data from freeways has made it possible to study the effects of speed variance in a much more rigorous and well-controlled manner than before. Data from loop detector may, if stored in suitable format, be used to reconstruct traffic in great detail. It then becomes possible to determine if the period immediately before an accident occurred was characterized by a larger speed variance than other periods.

Increased speed variance has been found to increase the risk of accidents. It should be added, however, that most of these accidents are probably property-damage-only accidents. Dense traffic characterized by frequent and sudden changes in speed is associated with a particularly high risk of accidents.