This paper proposes a comprehensive and unified framework for analysing the impacts on road safety of measures influencing speed. The key tool for analysis is a specification of the speed distribution, which in most cases closely approximates a standard normal distribution. Skewness in the distribution can be introduced by making one or both tails of the distribution fatter or thinner than the standard normal distribution. The validity of assuming a normal distribution should be tested prior to analysis.

It will normally be sufficient to identify sections representing one half of a standard deviation of the distribution and assume that the entire distribution is contained within the limits of plus or minus three standard deviations from the mean speed. The speed distribution will thus be made up of thirteen sections: the mean speed, six half standard deviations below the mean (-0.5, -1, -1.5, etc) and six half standard deviations above the mean (+0.5, +1.0, +1.5, etc).

The exponential model of the relationship between speed and the number of accidents or injured road users is then applied to estimate the expected number of accidents or injured road users for any part of the distribution. The upper part of the distribution will be associated with a higher expected number of accidents or killed or injured road users than the lower part of the distribution. It can be shown that the shape of the risk curve as applied to the speed distribution according to the exponential model is consistent with studies of how individual driver risk varies as a function of speed. Thus, the results of microlevel and macrolevel studies of the relationship between speed and road safety are consistent.

By relying on an exponential model fitted to speed distributions, a more comprehensive analysis of the impacts of road safety measures influencing speed becomes possible. In particular, road safety impacts of the following changes in speed can be analysed:

1. Shifting the whole speed distribution, as usually happens when new speed limits are introduced.
2. Compressing the upper end of the speed distribution, as usually happens when speed cameras or other means of enforcement are introduced.
3. Enlarging or reducing the variance of the speed distribution, while keeping mean speed constant.
4. Selective changes in upper regions of the speed distribution, for example as a result of changes in fixed penalties for speeding.

The paper illustrates how to test the validity of the assumptions made in analysis and how it can be applied to different sorts of data. Examples are given of how knowledge of the impacts of measures on speed or compliance with speed limits can be translated into expected changes in the number of accidents or killed or injured road users by relying on the exponential model.