International Co-operation on Theories and
Concepts in Traffic Safety

The relationship between road characteristics and driving speed in 30 km/h zones?

[1]*Schepers, P., [2]Drolenga, H., [2]Mieras, W., [3]Van Loo, W.
*lead presenter
[1] Paul Schepers, Rijkswaterstaat, The Netherlands
[2] Sweco, The Netherlands
[3] National Road Traffic Data Portal, The Netherlands

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Introduction
The Dutch Road Safety Strategic Plan 2030 aims to implement a risk-based road safety policy. Road authorities should identify risks based on Safety Performance Indicators (SPI's) and take appropriate action before accidents occur. The plan includes SPI's for road infrastructure and driving speed. Data are being collected across the whole country to measure the indicators and inform road authorities. The SPI for safe infrastructure includes measures in 30 km/h areas to entice driving speeds to a maximum of 30 km/h, especially speed humps. For the speed indicator, the V85 is measured: the speed that 85% of traffic adheres to.

This study aims to investigate the extent to which the density of speed humps along with other variables such as pavement type and traffic intensity affect driving speed in 30 km/h zones at an area level, i.e. not restricted to the location of an individual speed hump. The results can help to inform road authorities on which variables are most influential at the area level.

Research methodology
The organisation Nationaal Dataportaal Wegverkeersgegevens (NDW, National Road Traffic Data Portal) has been commissioned to collect road features, driving speed and volumes for all road links in the National Road Database (NRD). Speed humps were derived from a combination of the Large-Scale Topography Registry (LTR) that road authorities maintain and from high-resolution aerial photographs using Artificial Intelligence for image recognition because registration in LTR is not mandatory. The distinction between an open (most commonly pavers) or closed pavement (usually asphalt) is derived from the Large-Scale Topography Registry. Road authorities are required to maintain this road feature. In addition to infrastructure characteristics, NDW also collected data on traffic intensity and driving speed based on Floating Car Data. The V85 indicator for speed is measured for each 50 m segment while the traffic intensity is determined per road link.

All analyses are conducted in R. Statistics Netherlands' borough map is used to aggregate the average V85 for the 30 km/h roads in boroughs. For descriptive statistics the boroughs are split for each combination of independent variables:

- Speed hump density (speed humps per km road length) in four classes ranging from less than 4 to over 8 humps/km

- Open versus closed pavement
- Traffic intensity in two classes: under or above 1,000 motor vehicles per day

The relationship of the combination of the variables and V85 is examined in a multiple regression analyses for which all variables are aggregated at the borough level. Speed hump density and traffic intensity are treated as continuous variables in this analyses.

If available by August 2024, two other variables will be added to the analyses: the presence of road narrowings (a cheap but less well researched alternative to a speed bump) and the presence of separated bicycle paths (rare but not absent in 30 km/h zones).

Results

Some 46,000 km of roads in the Netherlands have a 30 km/h speed limit. Figure 1 (see next page) shows the V85 for all combinations of the independent variables. The result show that the higher the speed hump density is at these roads the lower its V85 is. Most (85%) of these roads have a low traffic volume (<1,000 mtv/day). Driving speeds are lower at low volume roads than on roads with a traffic volume over 1,000 mtv/day, on average a difference of 5 km/h. About two-thirds of the length of 30 km/h roads have an open pavement. Driving speeds at these roads are about 5 km/h lower than at those with closed pavement. A greater speed hump density is associated with lower speed in all conditions but its impact is greater where traffic density is higher and in combination with closed pavement where the speeds exceed the speed limit to a greater extent.

Results of the regression analysis are expected in September 2024. Multiple regression analysis is needed to isolate the impact of each variable. For instance, closed pavement is more frequent at busier 30 km/h roads which may cause part of the increased driving speed at these roads.

Discussion and conclusions

This is the first study in which the speed impact of speed hump density, pavement type, and traffic volume are investigated for all 30 km/h roads of a country with actual behaviour as dependent variable. The outcomes match the results of earlier studies: speed humps and open pavement are associated with lower driving speeds (Yeo *et al.* 2020, Theeuwes *et al.* 2024). The higher driving speeds at 30 km/h roads with over 1,000 mtv/day are likely due to them being designed more for collecting and distributing traffic within a neighbourhood. Aggregating the data at the borough level makes it possible to examine which combination of variables leads to a desired driving speed at the area level which is an advantage. A disadvantage is that it does not allow the precise longitudinal speed course around speed humps to be investigated.

Literature

Yeo, J., Lee, J., Cho, J., Kim, D.-K., Jang, K., 2020. Effects of speed humps on vehicle speed and pedestrian crashes in south korea. Journal of safety research 75, 78-86.

Theeuwes, J., Snell, J., Koning, T., Bucker, B., 2024. Self-explaining roads: Effects of road design on speed choice. Transportation research part F 102, 335-361.

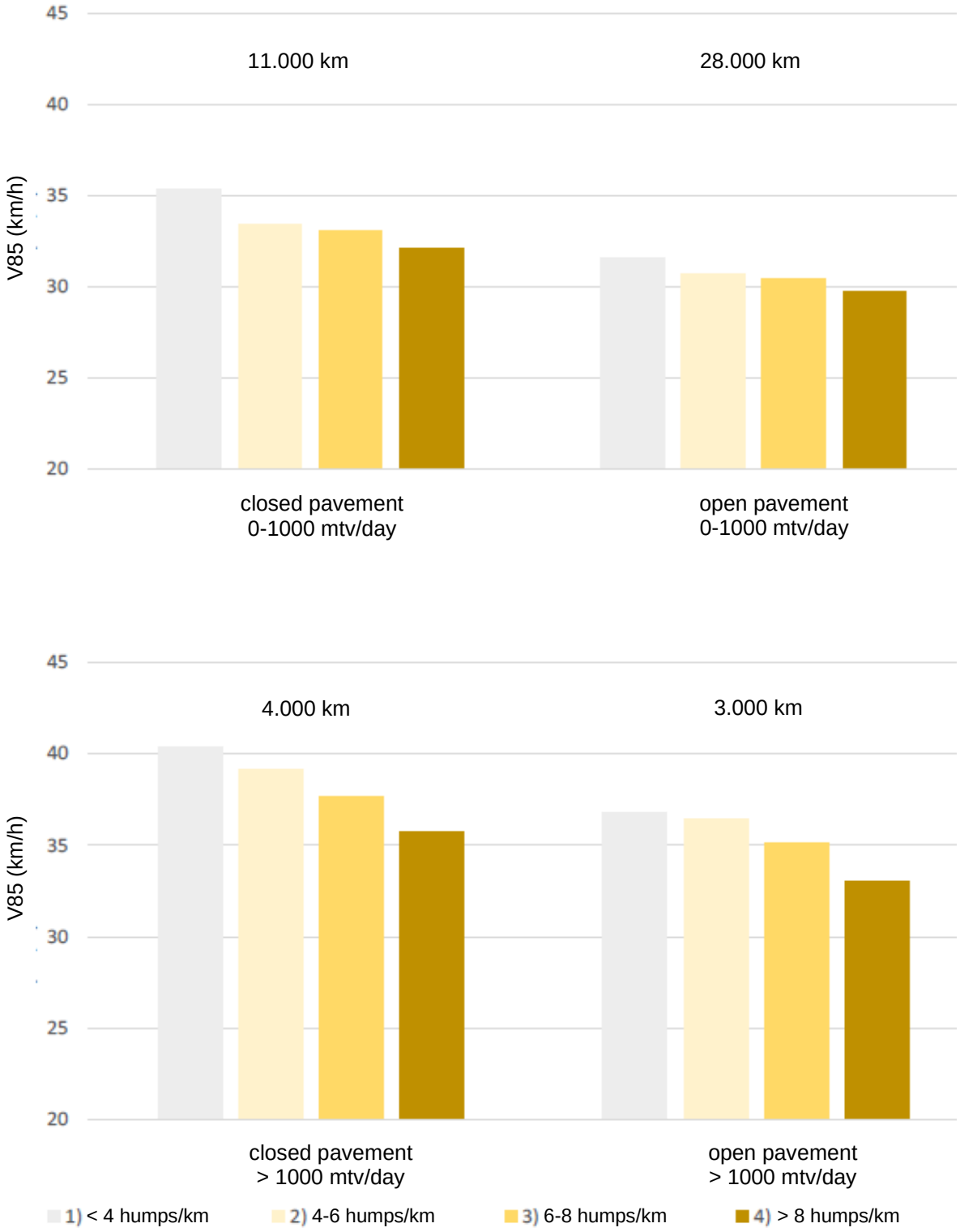

Figure 1 Speed versus speed hump density at 30 km/h roads with a traffic volume under (top graphs) and above (bottom graphs) 1,000 mtv/day and with closed (left graphs) versus open (right graphs) pavement