Automatic Detection
of Vehicular Axle Distances
at Tollgates

an MSc Thesis by PETRUS MURSANTO

Objective: Measuring distance between first and second axles (d) of vehicles as one determinant in Indonesian's Automatic Vehicle Classification (AVC) using a four-strip piezo treadle. The strips are 5 cm apart.

A four-strip piezo treadle is mounted on the lane, horizontally perpendicular to vehicles' direction. The treadle generates eight detection times (t_i), i.e. t_0, t_1, t_2, t_3 from first axle and t_4, t_5, t_6, t_7 from second axle.

t_0, t_1, t_2, t_3 gives an estimation of vehicle speed over treadle at first axle (V_f). $t_f=(t_0+t_1+t_2+t_3)/4$ is detection time of first axle at mid-point of treadle.

t_4, t_5, t_6, t_7 gives an estimation of vehicle speed over treadle at second axle (V_r). $t_r=(t_4+t_5+t_6+t_7)/4$ is detection time of second axle at mid-point of treadle.

The interval between t_f and t_r becomes the basis of analytical modelling and gives estimated values of d being measured.

Motor vehicle's technical specification is applied to calculate the trajectory of vehicle's extreme behaviour. V_{top} and V_{bot} are reached by vehicle at its maximum possible acceleration.

Extreme behaviour determines the maximum d and minimum d

$$\text{Estimated } d = \frac{(\max d + \min d)}{2}$$

maximum deceleration

V_{top}
V_r
V_f
V_{bot}

trajectory of V(t) with maximum d
trajectory of V(t) with minimum d

Δt