Het stimuleren van een betaal strook binnen een verkeersnetwerk met behulp van een op reistijdvariabiliteit gebaseerd keuzemodel

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The road network in the Netherlands will become more and more congested the upcoming years. Although policy is developed and executed to meet the expected congestion problems, it is expected that the accessibility of some important economic regions in the Netherlands will worsen. The introduction of pay lanes could be a measure to guarantee this accessibility for a share of the road users.

Pay lanes are separate lanes at highways that can only be used by road users that pay a certain toll for it. Pay lanes offer road users an extra service, because at pay lanes a low travel time is guaranteed. Road users are free to choose to use the (congested) free lanes or use the pay lane after paying for a guaranteed low travel time. In the United States several pay lanes have been constructed. Evaluation reports about these pay lanes are very positive. As a consequence of the pay lanes the travel times at the free lanes is improved and road users from all income classes use the pay lanes.

The willingness to pay for a pay lane is caused by both the reduction of travel time and the reduction of travel time variability. A reduced travel time variability gives road users a better indication of their arrival time, what seems to be very valuable for road users that have a great need to arrive on time.

To be able to estimate the potential effectivity of pay lanes in the Netherlands, an estimation has to be made about the valuation of this travel time variability by Dutch road users. Because no pay lane situations are available in the Netherlands, these estimations need to be made with a traffic model in which also the travel time variability has to be incorporated. Therefore the following research objective is formulated:

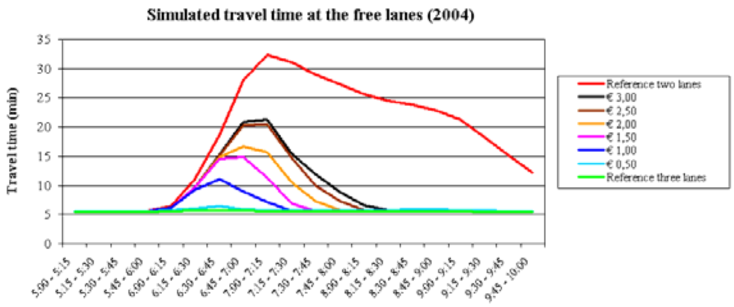
Research objective: The objective of this research is to develop a travel time variability based choice model and using this model to simulate two concrete pay lane situations in the Netherlands to get an indication of their effectiveness.

The two concrete pay lane situations are a potential pay lane at the 27 parallel to the Merwede Bridge near Gorinchem and a pay lane at the off-ramp Near Sloten in Amsterdam.

The network model used for the pay lane situations has been taken from the national accessibility model. The national accessibility model is a model developed by Goudappel Coffeng. The road users are divided in the different user classes, which vary in their preferences. The pay lane is added as a separate route in the network. In an iterative procedure the road users are assigned to the road network and subsequently to the pay lane or the free lane.

Simulation results of the pay lane situation at the A27

At the Merwede Bridge the road capacity is lower than at the other road sections at the A27. A pay lane is simulated along the bridge and the congested road section upstream. This pay lane situation is simulated for different toll levels, and two reference situations. The references consist of the old situation (only two free lanes) and a regular road capacity enlargement (three free lanes). The simulation of the road network in 2004 results in the travel times at the free lane as shown in the figure below.



The congestion that occurs in the old situation is strongly reduced by the pay lane. The congestion effects are fully taken away in the reference situation with three lanes (In the 2020 network this reference situation leads to small congestion effects).

A comparison of the travel costs as a sum of the travel time costs, the schedule delay costs and the toll costs, is shown in the table below. In the individual travel costs the toll costs are included. In the social travel costs, the toll costs are excluded because they are benefited by society as a whole. The pay lane strongly reduces travel costs in comparison with the old situation. At the same time the travel costs for the pay lane are much higher than the reference situation with three lanes, despite the benefits of a guaranteed low travel time.

	Travel time costs	**Schedule delay costs**	**Toll costs**	**Individual travel costs**	**Social travel costs**
2004 – Reference three lanes	29760.49	11122.5	0	40882.99	40882.99
2004 - Pay lane (toll 2,00)	36501.16	10647.9	13385.74	60534.81	47149.06
% - effect	23%	-4%		48%	15%
2020 – Reference three lanes	54824.66	23357.25	0	78181.92	78181.92
2020 - Pay lane (toll 3,00)	73772.16	20763.71	30507.66	125043.5	94535.86
% - effect	35%	-11%		60%	21%
2004 - Reference two lanes	97221.53	18537.5	0	115759	115759
2004 - Pay lane	36501.16	10647.9	13385.74	60534.81	47149.06
% - effect	-62%	-43%		-48%	-59%

In comparison with the pay lane locations in the United States, these pay lane simulations result in a quite low monetary valuation of schedule delay. This can be partly explained by the fact that the used valuation parameters are based on the monetary valuation of a regular schedule delay and not on a stochastic distributed schedule delay. Also the travel time variability is not included as a traffic flow dependent variable within the simulation procedure.

The simulation results show that the addition of a pay lane can reduce the congestion effects at the free lane. In contrary to a regular capacity enlargement, private exploitation of a pay lane can offer a private company return on investment. From this perspective a pay lane seems be an interesting measure to reduce congestion.

It is recommended to investigate the valuation of a stochastic distributed schedule delay in order to be able to make a good comparison between a pay lane situation and a reference situation with a regular capacity enlargement.

Simulation results of the off-ramp near Sloten in Amsterdam
The off-ramp near Sloten has sometimes insufficient road capacity. This results in a queue at the off-ramp and even at the main lanes of the highway. As a consequence on-going traffic is hindered. A pay lane alternative is simulated where a longer off-ramp is constructed that forms a buffer where road users can wait. The old off-ramp is used as a fast pay lane alternative.

A first test of the pay lane situation results in a total gridlock at the network. This gridlock is the result of a changed route choice by almost all road users that use the off-ramp. Other off-ramps are more attractive than the long new off-ramp or the old off-ramp where toll is charged. This massive changed route choice (which leads to a worse situation for everyone) can also be explained by the modelling structure of OmniTrans. Because route choice is determined in a static traffic assignment and the traffic conditions are determined in a dynamic traffic assignment, road users make the route choice is not based on the occurring traffic situations, but on a much smaller congestion effect that is estimated by the static traffic assignment.

For this reason no further simulations are executed for this pay lane situation. A conclusion that can be drawn from this simulation is that road users at the off-ramp do not have a benefit from the changed situation. The road users that benefit from this situation are the on-going road users that are no longer hindered. Because the toll is charged for road users that are not the problem owners, the probability that the road user decides to avoid the pay lane and change his route choice is much larger. In this case this has a strong negative effect for the traffic conditions at the Amsterdam road network.