

# INFORMATION SOCIETY TECHNOLOGIES (IST) PROGRAMME



## AIDE IST-1-507674-IP

### Driving Simulator Tests and Data Analysis for DVE model validation

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## Executive Summary

The objective of this study is to discuss the process of experimental data collection and analysis of real driver performances. These results will then be utilised for the validation set up of the SSDrive numerical simulation tool (presented in D1.3.3).

The first part the Deliverable focuses on the experiments carried out in the simulator of VTI. A set of specified scenarios with predetermined events were produced in the VTI driving simulator: in total 36 drivers drove in the simulator. Driver experience varied between three types of drivers, namely novices, average drivers and professional/experienced drivers. Similarly, three levels of distraction (no distraction, medium and high level of distraction) were induced by a simulated IVIS and were varied within drivers.

A number of research hypotheses and research questions were made with particular attention to Braking Behaviour (BB) and Standard Deviation from Lateral Position” (SDLP). These are summarised as follows:

- BB differs between drivers depending on their driving experience;
- BB differs depending on how distracted the drivers are;
- BB is affected by distraction to a greater extent for inexperienced drivers than for experienced drivers.
- SDLP differs between drivers depending on their driving experience
- SDLP differs depending on how distracted the drivers are.
- SDLP is affected by distraction to a greater extent for inexperienced drivers than for experienced drivers.

In general, it is assumed that the DVE model is able to reproduce the same average value for BB and SDLP as was produced by the real drivers, with concern taken to experience and distraction.

The experiments considered a road based on a real road with the speed limit of 90 km/h. A 10 km section of the road was used and repeated 6 times. For each of the sections the distraction level varied in three steps based on the HASTE arrows task (no task, medium difficulty and great difficulty). The order of the sections was rotated between subjects to counterbalance possible learning effects. There are no landmarks along the road so the drivers did not notice that the road was repeated. On three of the six sections the driver encountered events that required a speed reduction and/or a yielding manoeuvre. In total there were six events, i.e., two events on each of the sections with events. These events were also counterbalanced between subjects. The severities of the events were set at a low level, i.e. no panic manoeuvres were required to avoid an accident.

In the second part of the Deliverable, the collected data have been organised in order to carry out an accurate analysis at qualitative as well as quantitative level. In particular, four dependent variables were selected among all others, to enable the representation of the braking behaviour and SDLP. There are: the distance (at which a certain operation starts), the speed, the pressure (force) on brake pedal and the lateral-position.

In order to carry out the study and focus on well defined moments of the experiments, a number of specific positions and conditions (both in terms of distraction and risky situations) were selected. Then the qualitative analysis was performed and a number of conclusions were reached. These can be summarised as follows:

- There are different deceleration profiles in reacting and approaching a road event. Three different “styles” have been noticed, which are not necessarily associated with the levels of expertise of drivers.
- The different deceleration profiles are cross-groups, present in different measures in Novice drivers as well as in Average and Professional drivers. It seems therefore that experience, at least in the way considered in this study, does not justify driving behaviours variability.
- SDLP did not show significant results in almost all the comparisons carried out. Mean values of SDLP were not significantly different among the three groups in normal driving conditions. Under the influence of distraction, the only significant difference between mean values of SDLP was found in Professional drivers groups: passing from a no distraction condition to a great distraction one influence their lateral behaviour variability.
- The adoption of the mean speed to compare between groups would not reveal so much information about the existence of different profiles, and would surely show a great dispersion around mean values, i.e., high Standard Deviations. Using mean values of dependent variables for all the groups would mean to flatten these within-groups variability.

With respect to the quantitative analysis, a variety of graphical representations of braking behaviours in different conditions (distraction and risky situations) and precise positions of the road have been reported, according to different types of driver expertise. Similarly, a number of graphical outputs are presented for the SDLP. These set of outputs are utilised to support and confirm the qualitative analysis and offer the reference results against which predictions of the computerised simulation (the SSDRIVE output) will be confronted for the validation study to be carried and discussed in the Deliverable D1.3.3.