TRANSFORMERS

DELIVERABLE REPORT

DELIVERABLE N^0:	**D4.3**
DISSEMINATION LEVEL:	**RESTRICTED**
TITLE:	**THEORETICAL VALIDATION OF THE DRIVING CONTROLS STRATEGY AND SAFETY/STABILITY ASSESSMENT BY SIMULATION AND BENCHMARKING**
DATE:	**07/09/2016**
VERSION:	**FINAL**
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GRANT AGREEMENT N^0:	**605170**
PROJECT TYPE:	**THEME 7 TRANSPORT – SST GC.SST.2012.1-5: INTEGRATION AND OPTIMISATION OF RANGE EXTENDERS ON ELECTRIC VEHICLES**
PROJECT ACRONYM:	**TRANSFORMERS**
PROJECT TITLE:	**CONFIGURABLE AND ADAPTABLE TRUCKS AND TRAILERS FOR OPTIMAL TRANSPORT EFFICIENCY**
PROJECT START DATE:	**01/09/2013**
PROJECT WEBSITE:	**WWW.TRANSFORMERS-PROJECT.EU**
COORDINATION:	**VOLVO (SE)**
PROJECT MANAGEMENT:	**UNIRESEARCH (NL)**

Executive summary

Within the TRANSFORMERS project, one of the goals is to design a (semi-)trailer which has traction capabilities by means of an installed electric motor on one of the (usually three present) trailer axles. In the course of the TRANSFORMERS project, this new configurable truck will be developed and tested against the standard European heavy vehicle (conventional vehicle).

The additional traction, on one of the axles of the trailers, may influence the driving dynamics of the whole tractor-semitrailer combination. Task 4.3, of the TRANSFORMERS project, studies the influence of this Hybrid-on-Demand trailer on the stability of the combination. If it is found that the added traction causes stability risks, countermeasures and/or design rules are derived to mitigate these possible negative effects.

First a study is conducted to determine a set of critical manoeuvres with respect to loss of stability. Once this set is known, they will each be simulated using a validated tractor-semitrailer simulation model.

The second step of this work involves computer-based modelling to be conducted by TNO and IFSTTAR. The same tractor-semitrailer vehicle is modelled using two different simulation software packages:

- Matlab/SimMechanics, and
- PROSPER/SCANeR.

The work in Task 4.3 can roughly be split in two parts:

- ***Open loop simulations***; here, the actual position/orientation with respect to the road is of no importance. These type of simulations aim to characterize the dynamic properties of the vehicle combination. Typically, these types of manoeuvres will be executed on closed test-tracks.
- ***Closed loop simulations***; here, the position/orientation with respect to the road is important. These simulations are mainly performed to research the swept-path of the combination, but also the stability of (lateral) vehicle controllers.

The open loop simulations were be performed in Matlab/SimMechanics (by TNO), as this model is aimed for open loop vehicle dynamics simulations.

The closed loop simulations were be performed in PROSPER/ScANER (by IFSTTAR). This simulation tool contains sophisticated driver models which enables driving along a predefined path.

Both simulation packages used the same representation of the tractor-semitrailer. To guarantee that both models (TNO and IFSTTAR) indeed have the same dynamics, first a benchmark has been performed between the two implementations. The setup of this benchmark exercise and the results are presented in D4.3.

The third part focusses on the implementation of the driven trailer axle into the simulation models. Several configurations of the driven axle concept are simulated using the set of manoeuvres derived in the first part of this task and compared to the behaviour of a conventional tractor-semitrailer, for several different environmental conditions (e.g. wet, dry, etc.). The results of these simulations can be found in D4.3.

The results of the above simulations are analysed and, for those cases in which a degraded performance is observed, countermeasures and/or design guidelines are set up, which guarantee that the dynamics of the HoD-concept will never be less stable than a conventional tractor-semitrailer combination.

Acknowledgment

This project has received funding from the European Union's Seventh Framework Programme for research; technological development and demonstration under grant agreement no 605170.

http://cordis.europa.eu/fp7/cooperation/home_en.html

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