

VERTEC

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ABSTRACT

VERTEC (Vehicle, Road, Tyre and Electronic Control systems interaction: increasing active vehicle safety by means of a fully integrated model for behaviour prediction in potentially dangerous situations) is a research project funded for the most part by the European Union. The expected “integrated” use of the most advanced technologies to improve Transport Safety meets both the general objective of EU to reduce road fatalities (with a contribution of about 0.5%) and also four European Union policies:

- The “Common Transport Policy” strongly stresses the importance of Road Safety, calling for a “global” approach and underlining the human factor as one of the key contributory factors to an accident. VERTEC aims to investigate human reactions interacting with electronic control systems, considered as one of the most important aspects of Active Road Safety.
- The action programme "Sustainable Mobility: Perspectives for the Future" adopted December 1, 1998, by the Commission, sets out the initiatives it intends to take to ensure "sustainable mobility" within the European Union, in other words to encourage the development of efficient and environmentally friendly transport systems that are safe and socially acceptable. VERTEC aims to contribute both to an actual reduction of accidents and an improvement of the interaction (?) between vehicles, electronic controls, tyres and roads, and therefore driver reactions, stress, strain and comfort.
- Since 25 to 30 per cent of all road deaths in Europe (43,404 in EU15 in 1997) result from crashes involving trucks, the Commission has recently introduced a proposal for a new EU Directive which, as from 2003, will require all new trucks over 3.5 tonnes to be designed to prevent the serious consequences of crashes involving the fronts of cars under running the fronts of lorries, and will aim to improve UN ECE Regulation (No 93) in order to reduce car occupant fatalities by 4 to 6 percent (saving 1000-1500 lives annually).

VERTEC contributes to this effort by tackling additional issues related to Active HGV Safety.

The European Union (EU) needs an integrated transport system that serves the needs of business and individuals, with easy connections between its different parts. The development of this system requires investment in trans-European infrastructures to ensure that passenger and freight transport across the Union and beyond, is fast, reliable and safe. The ranking and detection of most dangerous situations, as established by VERTEC, might also represent a basis for the development of Intelligent Warning Systems, thereby contributing to Intelligent Transport Systems policy.

INTRODUCTION

Passenger and pedestrian injuries are today a major social problem in Europe. Passive and Active safety in transport systems involve numerous items, such as roads, tyres, electronic control systems and vehicle design. Moreover, the driving environment strongly influences the comfort, stress, strain and reactions of the driver, and therefore the quality of his driving.

The VERTEC Project addresses the problem of Land Transport Safety and aims to improve Active Vehicle Safety by developing an integrated model for the simulation of the road-tyre-vehicle-driver system in the most dangerous situations (presence of water, ice, snow, etc.). Special focus will be placed on the most

advanced Vehicle Electronic Control Systems (ABS, etc.) and the representation of both Passenger Cars and HGV (Heavy Goods Vehicles).

LINK WITH ROAD SAFETY

The focus on both Passenger Cars and HGVs also including Electronic Control Systems can be clearly seen as currently critical in terms of reduction of road deaths for mainly two reasons:

- 25 to 30 % of all road deaths in Europe result from crashes involving trucks [1], [5], due to the dramatic percentage of fatalities in accidents involving trucks
- Electronic Control Systems (ECS) have become a general commodity for passenger cars (e.g. nearly 100% of new cars sold in Germany feature ABS) and are now also significantly used in HGVs: their rapid development and widespread use makes it necessary to investigate their interaction with other car components (e.g. tyres) and also with highly complex human reactions (e.g. are ECS interventions desirable and easy to control for drivers?).

Active Road Safety can be successfully addressed only by working at a European level and with the aid of the most advanced technologies currently available: this project will draw on the work of a Consortium representing both the main EU countries and automotive sectors, sharing and merging the best vehicle development technologies:

- Top-Level Simulation approach
- Special Testing Devices for Tyres, Vehicles and Control Systems
- Driving simulator and detailed modelling of human reactions
- Web-based data exchange

Following EU recommendations for safety improvement, this project plans to approach the subject with a rational, systematic and integrated approach: after the definition of the Modelling Environments, Reference Cars and HGVs, reference components (tyre, control systems, etc.), reference test conditions and project web site (WP1), a parallel activity for modelling and testing entire vehicles and all the components will be performed, with specific attention to the representation of human drivers and their interaction with ECS (WP2, WP3, WP4, WP5, WP6).

MAIN VERTEC OUTPUT

All these experiments will be merged together into an integrated and validated simulation environment and an upgraded Driving Simulator is expected to be available after 24 months (the total duration of the project being 36 months). During the last 12 months, these technologies will finally detect and rank the most dangerous situations in order to supply guidelines for the design of safer and more advanced roads, light and heavy vehicles, tyres, electronic systems and driving simulators (WP7).

In this way, the main project output can be summarised as:

- Guide lines for the “Optimised Design” of more advanced Vehicles, Roads (including their maintenance and the potential development of automatic Hazard Warning Systems), Tyres and Electronic Control Systems aimed at improving Active Safety. These guidelines are expected to contribute to the improvement of accident prevention involving the tyres, vehicles, ECS and roads launched on the market 2 years after the end of the project.
- Detection and Ranking of the most dangerous situations taking into account the presence of heavy/light vehicles and electronic control systems and their interaction with drivers. In particular, such an investigation focuses on the most dangerous combination of environment/weather/road conditions (e.g. presence of water, ice, snow, etc.) and the interaction between driver reactions and ECS both for cars and trucks. In this way, final end-users might be not only vehicle and component manufacturers, but also Governmental Institutions and Road Research institutes.

TOOLS USED IN VERTEC

The following “tools” will be developed during the project in order to achieve the expected results, and can also be regarded as durable VERTEC products:

- Integrated simulation environment suitable for Transport Safety investigation and Time to Market reduction, allowing a detailed representation of both Cars and Trucks, ECS, human driver, tyre-road interaction.
- Improved Driving Simulator for Cars/Trucks, i.e. a full vehicle cabin with special motion systems reproducing the dynamics and screens reproducing the environment: such a device can reproduce in a very realistic way any driving task of both heavy and light vehicles in any environmental conditions, thereby making safety investigations possible without any risk for the drivers.

These achievements are expected to lead to both social and industrial benefits, meeting EU objectives and policies, e.g. Common Transport Policy, strongly stressing the priority of Road Safety.

Strong EC efforts are in fact currently underway, aiming for a 40% reduction in road fatalities by 2010, but up to now they have focused in particular on Passive Safety (e.g. improvement of existing UN ECE Regulation No.93 on HGV front under-run protection, new design of vehicle fronts to reduce danger for pedestrians and cyclists): VERTEC aims to contribute to such EU objectives with a general target of a 0.5% reduction in fatalities by 2010, by adopting an Active Safety approach. In this way, this project aims to contribute to a European Integrated Safety approach (preventive, active and passive safety), rather than an approach mainly focused on Passive Safety, as recently suggested by the EUCAR Council.

Moreover, this activity will meet EU policy objectives for Trans-European Networks/Intelligent Transport Systems for “fast, safe and reliable transport across and beyond the Union” and will support the improvement within Europe of a key-technology such as High-Level Driving Simulators for Cars and Trucks, which has undergone considerable development in the USA in the last years, thanks to substantial investments. Finally, the ranking of dangerous situations will aid the development of Warning systems for EU Intelligent Transport Systems.

VERTEC CONSORTIUM

The VERTEC Consortium will comprise, Vehicle, Tyre and Control System manufacturers, Road Maintenance Specialists, Transport Research Organisations and Technical universities: the presence of these partners, from six EU countries, makes it possible to cover all the main automotive fields and European environmental conditions, bringing together various experiences and skills. The European social and economic cohesion will strongly benefit from the co-operation between different European countries, medium and large companies as well as industry and universities. The partners from countries with a small local market will greatly benefit from the contact with the other partners and are likely to increase the acceptance of their products abroad.. Moreover, the presence of Technical Universities ensures a strong theoretical background and valuable opportunities to use the results while teaching students from different EU countries.

The main development area in the medium and long term will be the development of a new generation of safer Heavy and Light vehicles and car components, in addition to the improvement and maintenance of the Road network. The vehicle manufacturers and component suppliers will use the results of the project to increase their competitiveness by offering safer products, covering a valuable share of the European market. Moreover, as VERTEC particularly adopts a co-design process, a wide dissemination of the results among the companies (including also SME) co-operating with VERTEC partners is ensured. Universities will make use of the results in their consulting activity supporting automotive companies and in the education of young European engineers. The research institutes and consulting companies will use the project results to support their customers, as industries and governmental institutes, in the development of new and safer products with reduced time-to-market.

| Consortium Overview | | | |
|---------------------|----|---|--|
| Participant | | Business activity/Main Mission / Area of activity | RTD Role in project |
| Activity Type | NR | | |
| Pirelli (Italy) | 1 | Tyre Manufacturer | Co-ordinator, Tyre/pavement interaction assessment, Development and validation of vehicle models and assessment of vehicle performance, definition of design guide lines |
| Nokian (Finland) | 2 | Tyre Manufacturer | Tyre/pavement interaction assessment, Development and validation of vehicle models and assessment of vehicle performance, definition of design guide lines |
| Porsche (Germany) | 3 | Vehicle Manufacturer | Development and validation of vehicle models and assessment of vehicle performance, definition of design guide lines |
| CRF (Italy) | 4 | Vehicle Manufacturer | Reference tests on Passenger Cars and HGVs, development and validation of vehicle models, assessment of vehicle performance, definition of design guide lines |
| TRW (Germany) | 5 | Automotive Equipment | ECS modelling and validation, tests on vehicles, definition of guidelines |
| CETE (France) | 6 | Road Safety Organisation | Tyre/pavement interaction assessment, tests on vehicles, definition of design guide lines |
| TRL (England) | 7 | Road Safety Organisation | Tyre/pavement interaction assessment, tests on vehicles, definition of design guide lines |
| VTI (Sweden) | 8 | Road Safety Organisation | Tyre/pavement interaction assessment, development and validation of driving simulator, assessment of vehicle performance, definition of design guide lines, development and validation of vehicle models |
| HUT (Finland) | 9 | University | Tyre/pavement interaction assessment, winter tests, development and validation of vehicle models, assessment of vehicle performance, definition of design guide lines |
| UNIFI (Italy) | 10 | University | Tyre/pavement interaction assessment, assessment of vehicle performance, definition of design guide lines |
| VOLVO (Sweden) | 11 | HGV Manufacturer | HGV testing and modelling, development and validation of driving simulator, assessment of vehicle performance, definition of design guide lines |

CONCLUSIONS

Finally, the achievements of this project will improve the competitiveness of EU Automotive Products with respect to American and Japanese industry, both in vehicle manufacturing and High-Technology components, the market for which is expected to increase significantly in the coming years.

In particular, an indirect impact will be the increased knowledge about interaction between electronic driving control systems (ECS) and tyres. This will increase both road safety and the competitiveness of European vehicle and tyre manufacturers by helping to design more suitable tyres for ECS equipped cars or by helping to adjust ECS to present types of tyres.

The total effort of the VERTEC program is 607 man months.

The project started in December 2002 and will finish in December 2005.

REFERENCES OF RELATED PROJECTS

1. TIME, tire Measurements, Forces and Moments, EC Project DGXII, Standard Measurements and Testing, SMT4-CT95-2002.
2. TINO: Measuring, Understanding and Reducing Tyre Noise Emission under realistic Vehicle Operation Conditions, including the Contribution of the Road Surface, Brite-Euram 3, BRPR950121
3. VERT, Vehicle road tyre interaction: full integrated and physical model for handling behaviour prediction in potential dangerous situations, Brite-Euram 3, BRPR97 0461
4. PAV-ECO, Economic Evaluation of Pavement Maintenance & Life Cycle Cost at Project and Network Level, RoadTransport, RO-96-SC. 1085
5. DIVINE, Dynamic Interaction between Vehicles and Infrastructures Experiment, DSTI/DO/RTR/IR6(98)1/FINAL
6. TROWS, Tyre and Road Wear and Slip assessment G3RD-2000-00247
7. TROPHY Towards the prediction of Hydroplaning: Numerical Simulation and Experimental Validation GRD1-2000-25295.