EVSC05-14

Submitted by the expert of Hungary
3rd EVSC meeting, the 15th April 2005

Choice of ISO Standards for demonstration

1. Principles of choice

In the 2nd EVSC meeting a table of valid ISO standards was shown, being candidates for application in the demonstration chapter of the future EVSC regulation. However a selection from the point of view of practical applicability seems to be necessary. Those standards – without denying their relevance in given situations – are omitted in the present phase, which

- are of general nature, not directly bound to the task (ISO 15037-1 and Cor.1, ISO 15037-2)
- contain a fully static test, without rotating wheels, thus worthless for demonstrating a braking action (ISO 16333)
- were declared in the previous table as not applicable, e.g. because they contain a closed loop test (ISO/TS 20119, ISO 3888-1, ISO 3888-2)

Remark: on the other hand, the RUS standard as referred in the informal papers GRRF-55-20 and GRRF-57-07 was taken into consideration – see at the end of this paper

- are designed exclusively for vehicle combination tests (ISO 14791).

Remark:

Standards, which are applicable both for single vehicles and combinations, were not excluded on this basis. It is well known, that the approval system allows only single vehicles to be approved. At a vehicle performance assessment level, this principle should lead to the introduction of standardized „reference" trailers for a towing vehicle approval and vica versa, as a variety of realistic physical parameters of the other combination member may influence the final result. A differentation according to vehicle categories and construction principles (e.g. full trailers, centre axle trailers and semitrailers) is obviously necessary. Even the question of need of predefined physical input functions, to be introduced by the towing vehicle, could be arisen in case of a more advanced level of single trailer approval – simultaneously with the question of a series of practical preconditions when conducting physical tests (environmental conditions like adhesion, application of steering robot, safety measures etc.). In which depth these questions should be analysed and solved, depends very much on the chosen approval philosophy (i.e: „approval = design requirements + demonstration of EVSC function" or „approval = design requirements + performance assessment of EVSC function").

The research done up till now did not go ahead the agreement upon approval philosophy. The subject of simulation for demonstration purposes was a heavy vehicle combination, keeping in mind the later practical verification possibilities too. This simulation paves the way for exploring and solving problem areas and helps choosing the most effective test methods, taking into account, that the single vehicle case can be easily deducted from the combination results. Later, after having checked simpler methods, also the advanced ISO 14791 may be valuable from the point of view of demonstration by simulation; but on formal grounds, it does not fit to the present approval system.

- cover a specific aspect of stability (ISO 9815) (also contains a response of the trailer on a defined input at the coupling head; the same aspect for commercial vehicles – among others – is to be found also in the standard 14791).
- are only a slightly different variant of other standards of the list (ISO 9816); however the pairs of similar standards for commercial vehicles and passenger cars are still shown (and placed close to each other, marked with letters A and B), acknowledging, that the magnitude of the tested object justifies a practical differentiation.

A two part-standard (Passenger cars – Free steer behaviour: ISO 17288-1 and 17288-2), using steering wheel release in steady state turning and after a steering impuls in straight line driving was also omitted because it was felt, that it fits better to the development process of a system; the driving manoeuvre itself is not typical under real circumstances. The performance results would be surely different with and without EVSC; then further analysis would be needed, how to interprete these results.

So for the first approach, three pairs of characteristic standards for heavy commercial vehicles/passenger cars remain, as primary candidates for the demonstration of EVSC performance. The first two are related close to each other: standard Nr. 1 is the steady state circular test, where only selective or automatically commanded braking may occur, when EVSC is on. This event leads automatically to the relevance of standard Nr. 2., braking in turn. In its original form, the test circumstances of this latter one „only" differs from those of the steady state circular test by the superposition of the deliberate braking action of the driver. In contrary to the these tests, where each test run is done with a constant steering wheel angle, the third one shows the vehicle response on a variety of driver's steering actions (like pulse, step, sinusoidal etc. inputs) in open loop, when initially driving straight. It should be subject of further theoretical and practical research to choose the most recommended steer input manoeuvre(s).

The standards, which have been remained as preliminary candidates for simulation and demonstration purposes, are listed in the following table.

The last row in the table indicates the test method proposed by RUS in the informal papers GRRF55-20 and GRRF57-07. Other, than the ISO standards, this is a path following closed loop test, applicable for passenger cars and for commercial vehicles, both for single vehicles and vehicle combinations. Path geometry is given; width is depending on vehicle width. As input parameter, RUS suggests a function of steering wheel angular velocity, which results in (and can be substituted in the simulation by) a damped two periodic sinusoidal vehicle trajectory.

Nr.	Standard Nr.	Date	Title
1A	ISO 14792	2003	Road vehicles - Heavy commercial vehicles and buses – Steady-state circular tests
1B	ISO 4138	2004	Passenger cars – Steady-state circular driving behaviour- Open loop test methods
2A	ISO 14794	2003	Heavy commercial vehicles and buses – Braking in a turn - Open loop test methods
2B	ISO 7975	1996	Passenger cars - Braking in turn - Open loop test procedure
3A	ISO 14793	2003	Road vehicles - Heavy commercial vehicles and buses – Lateral transient response test methods
3B	ISO 7401	2003	Road vehicles - Lateral transient response test methods - Open loop test methods
4	GOST R 52302	2004	Single lane change test

2. Focus on standard assessment criteria

Paragraphs 5.2.1.31.5 and 5.2.2.21.4 of the regulation draft (presently EVSC04-01 Rev.2.) prescribe, that the demonstration „shall include the critical conditions of roll-over, under-steer and over-steer as appropriate to the vehicle/trailer stability function".

According to this provision, those output variables of the chosen standards have to be over all regarded, which are suitable to answer questions of self steering and roll properties of the vehicle. Assessing of EVSC effect is based on the analysis of the tendencies of these properties versus the independent variables, characteristic for the given standard, compared with the case, when EVSC is off. Especially at commercial vehicles, a basic element of judgement on high adhesion surfaces is a speed check, as EVSC applies typically radical braking to avoid rollover. That is why low adhesion demonstration, where self-steering properties are more relevant, is necessary as well.

The applicability of these standards, taken into account also some of the overmentioned environmental parameters, is checked at first by simulation. The results for standards Nr. 1A. and 4. of the table above are subject of the presentation EVSC05-15. Passenger cars and other standards follow later. Based upon the discussion of the 3rd EVSC meeting, the simulation results should be compared with results of practical tests.

3. Scope inconsistencies between standards and the regulation

The table above groups the scope of the standards to „Heavy commercial vehicles and buses" and to „Passenger cars". The standards themselves define their scope slightly more detailed, hovewer not fully in line with the scope of the regulation. The older standards do not contain references to vehicle categories. Instead, the standards ISO 4138 and 7401 refer to passenger cars and light trucks, the standard ISO 7975 refers only to passenger cars. Categories O1, O2 and M2 are excluded from the scope of each standard.

To involve light trucks (N1) in particular under the scope of the standard ISO 7975 is not problematic, but minibusses (M2) is a border case. Care should be taken, that the EVSC regulation does not exclude minibusses, even if EVSC systems for minibusses do not exist yet. From construction point of view, category M2 would fit perhaps better to the series of standards of commercial vehicles.

How to handle categories O1 and O2, is open. This is not an urgent question, because on the one hand, there is probably no real regulatory need, on the other hand, they are not fully uncovered: the standard ISO 9815, although strongly bound to the towing vehicle too, deals with the lateral stability of light centre axle trailers.

Until otherwise is decided, as a „work hypothese" we suggest to understand under
- „heavy commercial vehicles" the categories M3, N2, N3, O3, O4, (exactly following those standards, which contain a category listing) and
- „passenger cars and other light vehicles" the categories M1, M2, N1 (where category M2 is placed arbitrarily).