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Survey of ISO Standards

The table below compiles the currently valid ISO standards, dealing with the dynamic behaviour of road vehicles, and being candidates for application when evaluating the functionality of EVSC, keeping in mind, that ISO does not support the use of these standards for regulatory purposes. Any of them covers only a fragment of the dynamic behaviour and insufficient knowledge is available concerning the relationship between overall vehicle dynamic properties and accident avoidance. It is encouraging, that a series of standards for heavy commercial vehicles were recently introduced, similar to the well established standards of passenger cars, so now the degree of standardisation is about balanced in both vehicle groups. The standards typically contain the methodology but do not contain objective criteria for assessment, although they lead sometimes close to that.

Authorities however need a guidance for assessment of the functionality of the system. Therefore the actual applicability of the standards for demonstration purposes should be discussed in the EVSC group. Some standards have a limited scope and content, but the majority contains a wide variety of methods, probably more, than practicable within an approval process. A selection of the most practicable standards and methods together with their typical application field would facilitate the agreement between manufacturer and authority on the choice of appropriate method of demonstration. Bearing in mind legal consequences, open loop test procedures seem to be more suitable for assessment purposes, than closed loop procedures. A justification of the choice should be part of the test report.

The standards below themselves refer to further standards, mostly of basic importance, however not directly connected to the task, therefore not listed here. (E.g. ISO 8855 - Vehicle dynamics and road-holding ability - Vocabulary). ISO standards in preparation and others, than ISO standards (e.g. SAE practices) are also out of scope in this phase.

Nr.	Standard Nr.	Date	Title	Applicability for EVSC performance demonstration	Principle/main features, if applicable	Main output, if applicable
1	ISO 4138	2004	Passenger cars – Steady-state circular driving behaviour- Open loop test methods	yes; this standard provides basis of assessments done according to some other standards	3 basic methods: -constant radius -constant steering wheel angle -constant speed. One of the remaining variables is the independent one, the other is measured (together with other variables of interest) or calculated.	Gradients of dependent variable typically vs. lateral acceleration. Over-/understeer characteristics.
2	ISO 7401	2003	Road vehicles - Lateral transient response test methods - Open loop test methods	yes	Response on step, and one periodic sinusoidal, (time domain) and pulse, random, continuous sinusoidal (frequency domain) steering inputs	Time lag/response time, gain, overshoot of lateral acceleration, yaw velocity (time domain), amplitudes, phases of lateral acceleration and yaw velocity related to steering wheel angle (frequency domain)
3	ISO 7975	1996	Passenger cars - Braking in turn - Open loop test procedure	yes	Braking with stepwise rise of longitudinal acceleration in steady-state turning condition (constant radius and initial speed).	Characteristic maximum values at 1 s after beginning of braking, compared to reference values (in that moment as if the initial radius were maintained): yaw velocity, lateral acceleration, slideslip angle etc. Their differences in function of longitudinal acceleration. Also: path deviation and position of the vehicle during and at the end of braking etc.

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4	ISO 9815	2003	Road vehicles - Passenger car and trailer combinations - Lateral stability test	yes (valid for a given vehicle combination only)	Driving in a steady-state, straight-ahead condition, a single predetermined steering input excites the trailer coupling point in lateral direction. The damping characteristics in function of speed is evaluated. An initial steady state circular driving is also possible.	The free oscillation of the yaw articulation angle between towing vehicle and trailer has to have a positive damping. Characteristic is the zero damping speed, where this condition is not fulfilled anymore - this speed has to be anyway beyond a predetermined traffic speed.
5	ISO 9816	1993	Passenger cars -Power-off reactions of a vehicle in a turn - Open loop test methods	may be regarded together with 3 - no principal difference	Releasing the accelerator pedal during steady-state circular driving, in function of lateral accelerations	similar to as in 3
6	ISO 14791	2003	Road vehicles - Heavy commercial vehicle combinations and articulated buses – Lateral stability test methods	yes, only for vehicle combinations	Main test manoeuvres: - single lane change, - pulse or single sinusoid input (time domain); - pseudo-random input (frequency domain). Speed, lateral acceleration and frequency varies (depending on test).	Characteristic outputs of - free response: damping speed, yaw damping, see also in 4) - forced response: rearward amplification of lateral acceleration and yaw velocity, dynamic offtracking. (Huge number of variables)
7	ISO 14792	2003	Road vehicles - Heavy commercial vehicles and buses – Steady-state circular tests	yes; see Nr.1	see Nr. 1; methodology differences due to sizes, mass, nr. of axles etc.	see Nr. 1

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8	ISO 14793	2003	Road vehicles - Heavy commercial vehicles and buses – Lateral transient response test methods	yes; see Nr.2 also for a unit of a vehicle combination	see Nr. 2; methodology differences due to sizes, mass, nr. of axles etc.	see Nr. 2
9	ISO 14794	2003	Heavy commercial vehicles and buses – Braking in a turn - Open loop test methods	yes; see Nr.3 Tractor-trailer combinations are included	see Nr. 3; methodology differences due to sizes, mass, existence of retarder, nr. of axles and vehicle units etc.	see Nr. 3
10	ISO 16333	2004	Heavy commercial vehicles and buses – Steady state rollover threshold – Tilt-table test method	indirectly yes, as a basis	To fix an initial state of a basis vehicle for comparison; also to filter out inappropriate basis vehicles. See also: ECE R107, R111	Tilt angle ratio = $\tan(\text{tilt angle})$ at the occurrence of critical wheel lift.
11	ISO/ TS 20119	2002	Road vehicles - Test method for the quantification of on-centre handling - Determination of dispersion metrics for straight-line driving	no		
12	ISO 3888-1	1999	Passenger cars - Test track for a severe lane-change manoeuvre - Part1: Double lane-change	no	closed loop method - only the test track is standardised	basis of ranking: usually the speed
13	ISO 3888-2	2002	Passenger cars - Test track for a severe lane-change manoeuvre - Part2: Obstacle avoidance	no	closed loop method - only the test track is standardised (remark: a shorter one as in 12)	speed is not applicable as basis of ranking

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14	ISO 15037-1	1998	Road vehicles - Vehicle dynamics test methods - Part 1: General conditions for passenger cars	yes, methodology basics	General methodology, instrumentation, accuracy etc. features, not bound to EVSC-specific standards	
15	ISO 15037-1 /Cor1	1998	Road vehicles - Vehicle dynamics test methods - Part 1: General conditions for passenger cars		Corrigendum of (14)	
16	ISO 15037-2	2002	Road vehicles - Vehicle dynamics test methods - Part 2: General conditions for heavy vehicles and buses	yes, methodology basics	General methodology, instrumentation, accuracy etc. features, not bound to EVSC-specific standards	
17	ISO 17288-1	2002	Passenger cars – Free steer behaviour – Part 1: Steering-release open loop test method	yes, as a basis	Return to the straight line following the release of the steering wheel in steady state turning in function of lateral acceleration.	Delay and damping of oscillation of characteristic values (yaw velocity, slideslip angle, steering wheel angle)
18	ISO 17288-2	2004	Passenger cars – Free steer behaviour – Part 2: Steering-pulse open loop test methods	yes	Return to the straight line following a single pulse steering wheel input and then releasing the steering wheel from a straight-ahead, steady state driving condition in function of speed.	Yaw velocity, steering wheel angle, slideslip angular velocity: oscillation, damping, functions of speed, lateral acceleration etc.