

Amended GRRF Ad-hoc Electronic Vehicle Stability Control Working Group Document as a result of 15<sup>th</sup> April 2005 meeting.

Based upon Document EVSC 04-01 Rev 2 – changes highlighted in yellow (old paragraphs 2.28. and 2.29. combined, old paragraph 5.2.1.31.4. included in paragraph 5.2.1.31.2., annex 2 simplified, annex 19 brought in line).

## Proposed amendments to ECE Reg.13,

**Explanatory Note** – this document has been prepared on the basis that it will be part of R13. Reg. 79 to be considered in the formulation of this amendment of Reg. 13.

### A Proposal (Provisions for vehicle stability control systems)

Add a new paragraph 2.32. to read:

**2.32.** “Vehicle Stability Function” means an electronic control function for a vehicle which improves the dynamic stability of the vehicle.

**2.32.1.** A vehicle stability function may include one or both of the following:

- directional control
- roll-over control

**2.32.2.** Control functions within a vehicle stability function:

**2.32.2.1.** “Directional control” means a function within a vehicle stability function that assists the driver in maintaining the vehicle in the direction intended by the driver in the case of a power-driven vehicle, and assists in maintaining the direction of the trailer with that of the towing vehicle in the case of a trailer.

**2.32.2.2.** “Roll-over control” means a function within a vehicle stability function that reacts to the potential of roll-over to stabilise the power-driven vehicle or towing vehicle and trailer combination or the trailer during dynamic manoeuvres.

Add a new paragraph 5.2.1.31 to read:

**5.2.1.31.** Special requirements for vehicles equipped with a vehicle stability function where the installation of such equipment is mandatory.

**5.2.1.31.1.** Where a vehicle is equipped with a vehicle stability function as defined in paragraph 2.32, the following shall apply:

In the case of directional control the function shall have the ability to automatically control individual wheel speeds by selective braking based on the evaluation of actual vehicle behaviour in comparison with a determination of vehicle behaviour demanded by the driver.<sup>1/</sup>

In the case of roll-over control the function shall have the ability to automatically control individual or multiple wheel speeds by selective braking or automatically commanded braking based on the evaluation of actual vehicle behaviour that may lead to vehicle roll-over.<sup>1/</sup>

**5.2.1.31.2.** To realise the functionality defined above a vehicle stability function shall include, in addition to selective braking and where appropriate automatically commanded braking, at least the following:

- The ability to regulate engine power output.
- In the case of directional control: The determination of vehicle behaviour from measured values of yaw rate, lateral acceleration and wheel speeds and from the driver's control input to the braking system, to the steering system, and to the engine.
- In the case of roll-over control: The determination of vehicle behaviour from measured values of lateral acceleration, wheel speeds and from the driver's control input to the braking system, and to the engine.
- In the case of a towing vehicle equipped according to paragraph 5.1.3.1.: the ability to apply the service brakes of the trailer via the respective control line(s) independently of the driver.

**5.2.1.31.3.** A vehicle stability function of a different design to that described in paragraph 5.2.1.31.2. above shall be deemed to fulfil the requirements of a vehicle stability function provided that at least equivalent performance is achievable.

The assessment procedure used shall be agreed between the vehicle manufacturer and Technical Service to ensure the objectives defined in 2.32. are fulfilled and shall include comparative testing with a representative vehicle fulfilling the specification defined in 5.2.1.31.2. above.

**5.2.1.31.4.** The operation of the vehicle stability control shall be demonstrated by means of one of the following:

- a dynamic test
- submission of test results from a representative vehicle including a demonstration of the stability function on a vehicle
- a computer simulation<sup>2/</sup>.

The method by which this demonstration is carried out shall be agreed between the vehicle manufacturer and the Technical Service and shall include the critical conditions of under-steer, over-steer and roll-over as appropriate to the

vehicle stability function installed on the vehicle with the method of demonstration and results being appended to the type approval report.

**5.2.1.31.5.** When the vehicle stability function is activated the driver shall be warned by a specific [yellow] optical warning signal. The warning shall be present as long as the vehicle stability function is active. The warning signals specified in item 5.2.1.29. of this Regulation shall not be used for this purpose. Interventions of the vehicle stability function used in any learning process to determine the vehicle operational characteristics shall not generate the above signal.

**5.2.1.31.6.** In the case of a power-driven vehicle equipped with an electric control line and electrically connected to a trailer with an electric control line the driver shall be warned by a specific [yellow] optical warning signal whenever the trailer provides the information “VDC Active” via the data communications part of the electric control line. The optical signal defined in paragraph 5.2.1.31.5. above may be used for this purpose.

**5.2.2.21.** Special requirements for trailers equipped with a **vehicle** stability function where the installation of such equipment is mandatory.

**5.2.2.21.1.** Where a trailer is equipped with a **vehicle** stability function as defined in paragraph 2.32. the following shall apply:

In the case **of directional** control the function shall have the ability to automatically control individual wheel speeds by selective braking based on the evaluation of actual trailer behaviour in comparison with a determination of the relative behaviour of the towing vehicle.<sup>1/</sup>

In the case **of roll-over** control the function shall have the ability to automatically control individual or multiple wheel speeds by selective braking or automatically commanded braking based on the evaluation of actual trailer behaviour that may lead **to roll-over**.<sup>1/</sup>

**5.2.2.21.2.** To realise the functionality defined above a **vehicle** stability function shall include, in addition to automatically commanded braking and where appropriate selective braking, at least the following:

- The determination of trailer behaviour from measured values of lateral acceleration and wheel speeds.

**5.2.2.21.3.** A **vehicle** stability function of a different design to that described in paragraph 5.2.2.21.2. above shall be deemed to fulfil the requirements of a vehicle stability function provided that at least equivalent performance is achievable.

The assessment procedure used shall be agreed between the trailer manufacturer and Technical Service to ensure the objectives defined in 2.32. are fulfilled and shall **include** comparative testing with a representative trailer fulfilling the specification defined in 5.2.2.21.2. above.

**5.2.2.21.4.** The operation of a **vehicle** stability function shall be demonstrated by means of one of the following:

- a dynamic test
- the submission of test results from a representative trailer **including a demonstration of the stability function on a vehicle**
- a computer simulation <sup>2/</sup>.

The method by which this demonstration is carried out shall be agreed between the trailer manufacturer and the Technical Service and shall include the critical conditions of roll-over, under-steer and over-steer as appropriate to the **vehicle** stability function installed on the trailer with the method of demonstration and results being appended to the type approval report.

**5.2.2.21.5.** Trailers equipped with an electric control line, when electrically connected to a towing vehicle with an electric control line, shall provide the information “VDC active” via the data communications part of the electric control line when the **vehicle** stability function is active. Interventions of the **vehicle** stability function used in any learning process to determine the **trailer** operational characteristics shall not generate the above information.

<sup>1/</sup> Additional interaction with other vehicle systems or components is allowed. Where these systems or components are subject to special Regulations, such interaction shall comply with the requirements of those Regulations, e.g. interaction with the steering system shall comply with the requirements set out in Regulation 79 for corrective steering.

<sup>2/</sup> Where a computer simulation is used as a means of demonstration, data shall be provided which verifies the simulation model against a practical vehicle test.

## Annex 2

Add a new paragraph 14.14. as follows:

**14.14.** **The vehicle is / is not <sup>2)</sup> equipped with a vehicle stability function**

**In the case where the vehicle is equipped with a vehicle stability function:**

<b>Vehicle stability function is optional equipment:</b>	<b>Yes / No <sup>2)</sup></b>
<b>Vehicle stability function includes directional control:</b>	<b>Yes / No <sup>2)</sup></b>
<b>Vehicle stability function includes roll-over control:</b>	<b>Yes / No <sup>2)</sup></b>

## Annex 19

Add a new paragraph 1.1.5. to read:

### 1.1.5. **Vehicle** stability function (refer to paragraph 6).

Add a new paragraph 6 to read:

## 6. **Vehicle** Stability Function

### 6.1 General

6.1.1 This paragraph defines a test procedure to determine the performance of a **vehicle stability function consisting of directional control and/or roll-over control**.

### 6.2 Information Document

6.2.1 The manufacturer of the **vehicle** stability function shall supply to the Technical Service an Information Document of the **control** function(s) for which performance verification is required. This document shall contain at least the information defined in Appendix 7 to this Annex.

### 6.3 Definition of test vehicles

6.3.1. Based on the information supplied in the Information Document, in particular the trailer applications defined in paragraph 2.1 of Appendix 7, the Technical Service shall carry out **demonstrative** tests on a representative trailer(s) having up to three axles and equipped with the respective braking system configurations. Additionally, when selecting a representative trailer(s) for evaluation consideration shall also be given to the parameters defined in the following paragraphs:

6.3.1.1. Suspension type: for each suspension group i.e. balanced pneumatic a representative trailer shall be evaluated.

Wheelbase: wheel base shall not be a limiting factor

Brake type: approval shall be limited to S cam or disc brakes but should other types become available, then comparative testing may be required.

Braking system: The braking system of the trailer(s) to be evaluated shall comply with all of the relevant requirements of this Regulation.

### 6.4 Test Schedule:

6.4.1. The **demonstrative** tests to be carried out shall be agreed between the system manufacturer and the Technical Service and shall **include the critical conditions of roll-over, under-steer and over-steer as appropriate to the vehicle stability function installed on the trailer**.

6.5 Towing vehicle: the towing vehicle used for evaluating the performance of the **vehicle (trailer)** stability function shall have the necessary pneumatic and electrical connections and if the **towing** vehicle is equipped with a vehicle stability function as defined in paragraph 2.32 of this Regulation that function shall be disabled.

Add a new Appendix 7 to Annex 19 as follows:

## Annex 19 – Appendix 7

### **Vehicle** Stability Function Information Document

- 1 General
  - 1.1 Name of manufacturer
  - 1.2 System name
  - 1.3 System variations
  - 1.4 System configurations (where appropriate)
  - 1.5 Explanation of the basic function and/or philosophy of the system.
- 2 Applications
  - 2.1 List of trailer types and configurations for which approval is required.
  - 2.2 Schematic diagrams of the respective configurations installed on the trailers defined in 2.1 above with consideration given to the following:
    - Lift axles
    - Steering axles
    - Anti-lock braking configurations
  - 2.3 Scope of application with respect to suspension type i.e. balanced pneumatic etc. with reference to the manufacturer and model/type.
  - 2.4 Additional information (if applicable) to the application of the **directional control and/or the roll-over control function(s)**.
- 3 Component Description
  - 3.1 Sensors external to the controller
    - Function
    - Identification e.g. part numbers
  - 3.2 Controller(s)
    - General description and function
    - Identification e.g. part numbers
    - Safety aspects of the controller(s) in accordance with Annex 18
    - Additional features
  - 3.3 Modulators
    - General description and function
    - Identification
    - Limitations
  - 3.4 Electrical Equipment
    - Circuit diagrams
    - Powering methods
  - 3.5 Pneumatic circuits
    - System schematics including anti-lock braking associated with the trailer types defined in paragraph 6.2.1 of this Annex
  - 3.6 Electro Magnetic Compatibility

- 3.6.1 Documentation demonstrating compliance with Regulation No. 10 including the 02 Series of amendments

Add a new Appendix 8 to Annex 19 as follows:

### Annex 19 – Appendix 8

#### **Vehicle** Stability Function Test Report

Test Report No: .....

- 1 Identification
  - 1.1 Manufacturer of the **Vehicle** Stability Function (name and address)
  - 1.2 System name / model
- 2 System(s) and Installations approved
  - 2.1 Anti-lock braking configurations (where appropriate)
  - 2.2 Range of application (trailer type and number of axles)
  - 2.3 System Identification
  - 2.4 Additional features.
- 3 Test Data and Results
  - 3.1 Test vehicle data:
  - 3.2 Test surface information
  - 3.3 **Demonstrative** tests used for the purpose of evaluating the **directional control and/or the roll-over control**.
  - 3.4 Test results
  - 3.5 Assessment in accordance with Annex 18 to this Regulation
- 4 Limits of installation:
  - 4.1 Suspension type
  - 4.2 Brake type
  - 4.3 Trailer installation
  - 4.4 Anti-lock braking configurations
  - 4.5 Other recommendations/limitations (e.g. lifting axles, steering axles etc)
- 5 Date of Test:

This test has been carried out and the results reported in accordance with Annex 19 to ECE Regulation 13 as last amended by the ..... series of amendments.

Technical Service <sup>1/</sup> conducting the test

Signed: .....

Date: .....

6 Approval Authority <sup>1/</sup>

Signed: .....

Date: .....

*<sup>1/</sup> To be signed by different persons even when the Technical Service and Approval Authority are the same or alternatively, a separate Approval Authority Authorisation issue with the report.*

Appendix 7 (former) is to be renumbered Appendix 9

---

## **B Notes to the proposal**

### **Terminology**

The terms “Vehicle Stability Function” and “Trailer Roll Stability Function” have been chosen as they are believed to be unconnected with a specific organization. Organization specific terminology includes – Vehicle Dynamics Control (VDC), Vehicle Stability Control (VSC), Electronic Stability Control (ESC), Electronic Stability Program (ESP), Electronic Stabilisation Programme (ESP), Porsche Stability Management (PSM), Dynamic Stability Control (DSC), Dynamic Stability Program (DSP), Roll Stability Program (RSP), Trailer Roll Stability Program (TRSP), Roll Over Protection (ROP), Roll Stability Control (RSC), and Roll Stability Support (RSS).

### **C Justification**

To be produced following agreement of the requirements.

### **D Mandated Categories (suggested)**

- Long distance touring coaches of Categories M<sub>3</sub> (Class III) as defined in Annex 7 to the Consolidated Resolution on the Construction of Vehicles (R.E.3) (vehicle stability function)
- Certain power driven vehicles and trailers subject to ADR certification:
  - Semi-trailer tractors of Category N<sub>3</sub> greater than 16 tonne except vehicles with more than 3 axles and off-road vehicles of Category N<sub>3</sub>G as defined in Annex 7 to the Consolidated Resolution on the Construction of Vehicles (R.E.3) (vehicle stability function)
  - Semi-trailers of Category O<sub>4</sub> with up to 3 axles (trailer roll stability function)

**E Lead time on the availability of systems regarding mandating (to be established based on actual availability/development programs)**

**F Towing vehicle – trailer stability compatibility**

Towing vehicle		Semi-trailer			Centre axle trailer			Full (drawbar) trailer		
		Without ABS	With ABS	With RSF	Without ABS	With ABS	With RSF	Without ABS	With ABS	With RSF
Tractor	Without ABS	OK	OK	-( <sup>1</sup> )	/	/	/	/	/	/
	With ABS	OK	OK	OK	/	/	/	/	/	/
	With VSF	OK	OK	OK	/	/	/	/	/	/
Truck	Without ABS	/	/	/	OK	OK	-( <sup>1</sup> )	OK	OK	-( <sup>1</sup> )
	With ABS	/	/	/	OK	OK	OK	OK	OK	OK
	With VSF	/	/	/	?( <sup>2</sup> )	?( <sup>2</sup> )	?( <sup>2</sup> )	?( <sup>3</sup> )	?( <sup>3</sup> )	?( <sup>3</sup> )

OK = no problem regarding the braking interaction of the combination vehicle

Notes:

- (1) Roll stability function (RSF) not functional due to no power supply – no ISO 7638 connector on towing vehicle. Stability of combination vehicle not effected – therefore, OK.
- (2) Identification problem between centre axle trailer and full trailer. Centre axle trailers behave as semi-trailers – therefore, OK; but full trailer behaviour is a potential problem due to rotational freedom between front axle(s) and rear axle(s) (see note 3).
- (3) Due to the rotational freedom between the front axle(s) and the rear axle(s) it may be advisable to automatically switch-off the truck vehicle stability function (VSF) when a full trailer is coupled so that possibility of trailer swing is minimised when the vehicle stability function comes into operation. Not clear if both directional control and roll-over control would be switched off, or only directional control.