Proposed amendments to the Proposal for Supplement 10 to the 11 series of amendments to Regulation No. 13

(Document GRRF/2012/2)

Note: the modifications to the current text of the regulation are marked in bold characters for new and strikethrough for deleted text. The modifications to the document GRRG/2012/2 are marked in red.

I. Introduction

In Regulation No.13, a simulation approval route exists beside the regular test approval route, in order for the vehicle manufacturers to be able to e.g. add new types or extend existing approvals. This simulation approval route is described in Appendix 1 to Annex 21. The simulation tool has to be validated on vehicles from the same manufacturer, and this validation should be based on tests performed on actual vehicles.

OICA welcomes a revision of the simulation route per Appendix 1 to Annex 21, based on the experience gained in the last years. OICA however is of the opinion that this revision should be an item separate to the AMEVSC discussions within the GRRF agenda.

II. Proposal

Annex 21, Appendix 1, amend to read:

"Annex 21

Appendix 1

Use of the dynamic stability simulation

The effectiveness of the directional and/or roll-over stability control function of power driven vehicles and trailers of categories M, N and O, may be determined by computer simulation.

1.   Use of the simulation

1.1.   The vehicle stability function shall be demonstrated by the vehicle manufacturer to the Type Approval Authority or Technical Service with the same dynamic manoeuvre(s) as for the practical demonstration in paragraph 2.1.3. or 2.2.3. of Annex 21.

1.2.   The simulation shall be a means whereby the vehicle stability performance may be demonstrated with the vehicle stability function enabled or disabled, and in the laden and unladen conditions.

1.3.   The simulations shall be carried out with a validated modelling and simulation tool. **The simulation tool shall only be used when the value of each parameters of the vehicle to be type-approved fall within the validated range of parameters of the simulation tool falls within the range of each respective parameter of the simulation tool**. The verification shall be carried out using the same manoeuvre(s) as defined in paragraph 1.1. above.

The method by which the simulation tool is validated is given in Annex 21, Appendix 2.

Justification: attempt for a clarification.

1.3.1.   **In the case where a validated simulation tool is used by a vehicle manufacturer for whom the simulation tool was not validated, a single confirmation test shall be conducted by the vehicle manufacturer in conjunction with a Technical Service. The confirmation test shall be a single comparison between an actual vehicle test and a simulation using one of the manoeuvres as defined in paragraph 1.1. above. The confirmation test shall be repeated in the event of a change to the vehicle stability function or simulation tool.**

The results of the confirmation test shall be attached to the type-approval documentation.

1.4.   **The availability of the simulation tool software, to the software version used, shall be maintained for a period of not less than 10 years.**"

Annex 21, Appendix 2, amend to read:

"**Annex 21**

Appendix 2

Dynamic stability simulation tool and its validation

1.   Specification of the simulation tool

1.1.   The simulation method shall take into account the main factors which influence the directional and roll motion of the vehicle. A typical **The simulation** model may **shall** include the following vehicle parameters as applicable in an explicit or implicit form [1]:

OICA points out that changing a "may" into a "shall" may complicate the validation of the simulation tool, in particular in view of the addition of a wide number of parameters. OICA suggests that GRRF defines a minimum list of mandatory parameters, and that the introducing paragraph then reads: "*The simulation model shall include **at least** the following parameters as applicable*".

(a)   Axle/wheel

(b)   Suspension

(c)   Tyre

(d)   Chassis/vehicle body

(e) ~~Power train/driveline, if applicable~~

(f) ~~Brake system~~

(g) ~~Pay load~~

(a) **Vehicle category**

(b) **Character of the vehicle;**

OICA points out that the definition of "character of the vehicle" will be introduced with the entry into force of the amendments of document WP29/2011/94, currently being pending to the solutions expected to the AMEVSC discussions.

(c) **Vehicle configuration(s) (e.g. 4x2, 6x2, etc., identifying axle functionality (e.g. free running, driven, lifted, steered) and position);**

(d) **Additional steering axles (e.g. forced steering, self-steering);**

Are these steering axles additional compared to those of an existing approval? Additional to what? For motor vehicles, the proper wording would better be "auxiliary steering axles".

(e) **Steering ratio;**

(f) **Drive axles (effect on wheel speed sensing and vehicle speed);**

(g) **Lift axles (detection/control and wheelbase change effect when lifted);**

(h) **Engine management (communication, control and response);**

(i) **Gearbox type (e.g. manual, automated manual, semi-automatic, automatic);**

(j) **Drive train options (e.g. retarder);**

Should read "endurance braking system"

(k) **Differential type (e.g. standard or self-locking);**

(l) **Differential lock(s) (driver selected);**

(m) **Brake system type (e.g. air over hydraulic, full air);**

(n) **Brake type (e.g. disc, drum (single wedge, twin wedge, S-cam);**

(o) **Anti-lock braking configuration;**

(p) **Wheelbase;**

(q) **Tyre type (e.g. structure, category of use, size);**

(r) **Track width;**

(s) **Suspension type (e.g. air, mechanical, rubber);**

(t) **Centre of gravity height;**

(u) **Lateral acceleration sensor position;**

(v) **Yaw rate sensor position;**

(w) **Loading.**

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[1] **Parameters not covered shall be a limitation on the use of the simulator**

1.1.1. **The Technical Service conducting the validation shall be provided with an information document covering at least the points in paragraph 1.1. above.**

1.2. The Vehicle Stability Function shall be added to the simulation model by means of:

a) A subsystem (software model) of the simulation tool **as software-in-the-loop**, or

b) ~~The~~ **An actual** electronic control ~~box~~ **unit** in a hardware-in-the-loop configuration.

1.3. In the case of a trailer, the simulation shall be carried out with the trailer coupled to a representative towing vehicle.

1.4. Vehicle loading condition

1.4.1. The simulator shall be able to take into account the laden and unladen conditions.

1.4.2. The load shall be considered to be a fixed load with **given** properties (mass, mass distribution and ~~maximum recommended~~ height of the centre of gravity) specified by the manufacturer.

Justification: deleting the last part of the sentence, it would not anymore be clear who decides about the properties. It is then suggested to re-introduce "specified by the manufacturer". This does not change if the AMEVSC approval route is followed, because the vehicle load conditions should be included in the AMEVSC test report.

2. Validation of the simulation tool

2.1. The validity of the applied modelling and simulation tool shall be verified by means of comparisons with a practical vehicle test(s). The test(s) utilised for the validation shall be those which, without control action, would result in loss of directional control (under-steer and over-steer) **and/**or roll-over control as appropriate to the functionality of the stability control function installed on a ~~representative~~ vehicle.

During the test(s) the following motion variables, as appropriate, shall be recorded or calculated in accordance with ISO 15037 ~~Part 1:2005~~ **2006**: ~~General conditions for passenger cars~~ or Part 2:2002: ~~General conditions for heavy vehicles and buses~~ (depending on the vehicle category):

Justification: As the scope of ISO 15037 Part I is restricted to M1 vehicles, this reference to part I can be deleted as UN R13 does not addresses passenger cars.

(a) Yaw velocity;

(b) Lateral acceleration;

(c) Wheel load or wheel lift;

(d) Forward velocity;

(e) Driver input.

4

2.2.   The objective is to show that the simulated vehicle behaviour and operation of the vehicle stability function is comparable with that seen in practical vehicle tests.

The ability of the simulator to be used with parameters that have not been validated by a practical vehicle test shall be shown by conducting simulations with varied parameter values. The results of these simulations shall be checked to be logical and similar in comparison to the results of known practical vehicle tests.

2.3.   The simulator shall be deemed to be validated when its output is comparable to the practical test results produced by the same vehicle during the manoeuvre(s) selected from those defined with paragraph 2.1.3. or 2.2.3. of Annex 21, as appropriate.

The simulator shall only be used with regard to features for which a comparison has been made between real vehicle tests and simulator results. The comparisons shall be carried-out in the laden and unladen condition to show the different conditions of load can be adapted to and to confirm the extreme parameters to be simulated, e.g.:

(a)   Vehicle with shortest wheelbase and highest centre of gravity;

(b)   Vehicle with longest wheelbase and highest centre of gravity.

In the case of the steady state circular test the under-steer gradient shall be the means of making the comparison.

In the case of a dynamic manoeuvre, the relationship of activation and sequence of the vehicle stability function in the simulation and in the practical vehicle test shall be the means of making the comparison.

2.4.   The physical parameters that are different between the reference vehicle and simulated vehicle configurations shall be modified accordingly in the simulation.

2.5.   A simulator test report shall be produced, a model of which is defined in Appendix 3 of this annex, and a copy attached to the vehicle approval report."

Annex 21, Appendix 3, amend to read:

"**Annex 21**

Appendix 3

Vehicle stability function simulation tool test report

Test Report Number: ....

1.	Identification

1.1.   Name and address of the simulation tool manufacturer

1.2.   Simulation tool identification: name/model/number (hardware and software)

2.   Simulation tool

2.1.   Simulation method (general description, taking into account the requirements of paragraph 1.1. of Appendix 2 to Annex 21)

2.2.   Hardware/software in the loop (see paragraph 1.2. of Appendix 2 to Annex 21)

2.3.   Vehicle loading conditions (see paragraph 1.4. of Appendix 2. to Annex 21)

2.4.   Validation (see paragraph 2. of Appendix 2 to Annex 21)

2.5.   Motion variables (see paragraph 2.1. of Appendix 2 to Annex 21)

3.   Scope of application

3.1.   Vehicle category:

~~3.1~~. **3.2**.   Character of **the** vehicle ~~(e.g. truck, tractor for semi-trailer, bus, semi-trailer, centre-axle trailer, full trailer)~~

See comment above

~~3.2~~. **3.3**.   Vehicle configuration: ~~(e.g. 4x2, 4x4, 6x2, 6x4, 6x6)~~

3.4.   Additional steering axles:

See comment above

3.5   Steering ratio:

3.6.   Drive axles:

3.7.   Lift axles:

3.8.   Engine management:

3.9.   Gearbox type:

3.10.   Drive train options:

3.11.   Differential type:

3.12.   Differential lock(s):

3.13.   Brake system type:

3.14.   **Brake type:**

3.15.   **Anti-lock braking configuration:**

3.16.   **Wheelbase:**

3.17.   **Tyre type:**

3.18.   **Track width:**

3.19.   **Suspension type:**

3.20.   **Centre of gravity height:**

3.21.   **Lateral acceleration sensor position:**

3.22.   **Yaw rate sensor position:**

3.23.   **Loading:**

~~3 3~~. **3.24**.   Limiting factors: ~~(e.g. mechanical suspension only)~~

~~3.4~~. **3.25**.   Manoeuvre(s) for which the simulator has been validated:

4.   Verifying vehicle test(s)

4.1.   Description of vehicle(s) including the towing vehicle in case of trailer testing:

4.1.1.   Vehicle(s) identification: make/model/VIN

4.1.1.1.   Non-standard fitments:

4.1.2.   Vehicle description, including axle configuration/suspension/wheels, engine and drive line, braking system(s) and vehicle stability function content (directional control/rollover control), steering system, with name/model/number identification:

4.1.3.   Vehicle data used in the simulation (explicit)

4.2.   Description of test(s) including location(s), road/test area surface conditions, temperature and date(s):

4.3.   Results laden and unladen with the vehicle stability function switched on and off, including the motion variables referred to in Annex 21, Appendix 2, paragraph 2.1. as appropriate:

5.   Simulation results

5.1.   Vehicle parameters and the values used in the simulation that are not taken from the actual test vehicle (implicit):

5.2.   Results laden and unladen with the vehicle stability function switched on and off for each test conducted under paragraph ~~3.2~~. **4.2.** of this appendix, including the motion variables referred to in Annex 21, Appendix 2, paragraph 2.1. as appropriate:

6.   **Concluding statement**

              The simulated vehicle behaviour and operation of the vehicle stability function is comparable with that of practical vehicle tests.

              Yes/No

7.	**Limiting factors**
8.	This test has been carried out and the results reported in accordance with Appendix 2 of Annex 21 to ECE Regulation No. 13 as last amended by the … series of Amendments.

Technical Service conducting the test [1] ....

Signed:.......... ....   Date: ....

Approval Authority [1].."

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[1]   To be signed by different persons if the Technical Service and the Approval Authority are the same organisation.