Working Document – draft 'justification' proposal prepared by AMEVSC Secretariat

Based on the documents AMEVSC-02-03e and AMEVSC-03-02e.

B. JUSTIFICATION

In developing the requirements for a vehicle stability function (Annex 21) it was recognised that the testing of its component functions, directional control and roll-over control, at the time of type-approval would be very onerous on both the vehicle manufacturer and the system supplier in terms of timing (winter testing – low μ surface for directional control, summer testing – high μ surface for roll-over control) and safety equipment (roll-cage, outriggers, anti-jack-knifing device). Therefore, Annex 21 contains the requirement for a comparative "demonstration" (system on, system off) on "one vehicle", where the demonstration is a dynamic manoeuvre to show directional control and a dynamic manoeuvre to show roll-over control.

As an alternative for other vehicles and other load conditions it is allowed to submit results from actual vehicle tests or computer simulations. In the case of a computer simulation, a Technical Service approved simulation tool must be used (Annex 21 Appendix 2).

As an alternative to the computer simulation it is proposed, via this amendment, to allow a Technical Service test report to be submitted.

For a number of years a Technical Service component test report (Annex 19) has been allowed to be used in the type-approval of trailers (Annex 20) and this amendment proposal extends the use of Annex 19 and Annex 20 to cover the vehicle stability function with regard to motor vehicles (the vehicle stability function for trailers is already included in Annex 19 and Annex 20). The existing content of Annex 19 and Annex 20 becomes Section A (trailers) with the new content being in a Section B (motor vehicles, vehicle stability function).

Annex 19:

The vehicle stability function which is integrated into the motor vehicle includes the same basic components and functionality irrespective of the vehicle type. Changes of parameters to suit specific vehicle characteristics such as wheelbase and centre of gravity height values may be necessary but the system itself remains unchanged. On this basis, vehicles can be selected and tested to cover worst case situations and the various vehicle characteristics that influence the performance of a vehicle stability function.

Therefore, the proposed Section B is structured as follows:

- An "Information Document" detailing the capability of the vehicle stability function for which the test report will be applicable is to be provided by the system manufacturer – paragraph 2.2. The content of the information document is defined (Appendix 11 to Annex 19) and it is required that the information document is attached to the test report.

- A listing of the vehicle characteristics to be considered in selecting vehicles to be tested is given in "Definition of test vehicle(s)" – paragraph 2.3.

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- A listing of the vehicle characteristics affecting the performance of the vehicle stability function and how they are to be evaluated in the testing for the test report is given in "Test schedule" – paragraph 2.4. The content of the test report is defined in Appendix 12 to Annex 19.

In considering the content of paragraphs 2.3. and 2.4. the following was taken in to account:

- Vehicle category/vehicle description

  The control logic for directional control and for roll-over control is the same regardless of vehicle category (e.g. N_3) or vehicle description (e.g. semi-trailer tractor). Therefore, a semi-trailer tractor can be considered to be a short wheelbase truck, and a truck can be considered to be representative of a bus. However, the intervention threshold may be different between a semi-trailer tractor, a truck and a bus. As a result, while test results can be read-across from one vehicle category/description to another, at least one vehicle category/description must be tested to allow the test report to be used for that vehicle category/description.

  In addition, in the case of buses, the fitment of outriggers requires a large amount of very significant structural work to be carried-out which means that the availability of such vehicles is limited.

- Drive orientation (left or right hand drive)

  No aspect of directional control or roll-over control is influenced by which side of the vehicle the driver sits and, therefore, tests carried-out on a left hand drive vehicle are equally applicable to a right hand drive vehicle and visa versa.

- Single front axle steering

  How the link between driver demand and the actual angular position of the road wheels is achieved has no influence on performance (the relationship is covered under "steering ratio"). As a result different steering arrangements are not evaluated.

- Additional steering axles

  Whether a 3rd axle is a fixed axle or a steering axle may have an influence on performance and, therefore, unless it is an end-of-line programming parameter (the control logic is adjusted to take its steering effect into account), it needs to be evaluated. Evaluation is by comparison of results with the steering axle in it normal operating mode and with it fixed in the straight ahead position.

- Steering ratio

  The steering ratio – relationship between steering wheel rotation and resulting road wheel angle – is critical in determining any difference between the driver's directional demand and the actual directional movement of the vehicle, and any corrective action by the vehicle stability function (directional control). Therefore, unless the ratio is an

end-of-line programming parameter or a self-learning feature in the control logic (which is required to be verified by testing for the test report), only vehicles having the same ratio(s) as that actually tested, can be type-approved.

- Lift axle

  Lifting an axle will change the vehicle wheelbase and the change in wheelbase may affect performance. Therefore, it is required to determine if the system is able to recognise a change in axle position and provide a signal to adjust the control logic.

- Engine management

  To optimise control the vehicle in a pending loss of stability situation, it is not only necessary to apply the brakes of appropriate wheels, but also to take control of the engine away from the driver. Therefore, this is to be evaluated not only in terms signal generation but also communication compatibility.

- Drive train options

  As with engine management, it is required to show that control (e.g. retarder control) is taken away from the driver.

- Differential type/differential locks

  The effect of self-locking or driver selected locking may affect the performance and, therefore, the effect is to be shown.

- Anti-lock braking configurations

  The ABS wheel speed sensors provide one of the inputs to the system and the ABS modulators control the output of the system and, therefore, the ABS configuration is significant in terms of system performance. In the case of end-of-line programming of the ABS configuration, each vehicle configuration being evaluated is to be tested with a different ABS configuration to demonstrate that the system is able to adjust its control logic. In the case of no end-of-line programming, each ABS/vehicle configuration is tested. As the vehicle stability function is built into a host system, e.g. ABS, EBS, each host system is to be tested.

- Wheelbase

  While wheelbase influences performance, it can be a major logistic problem to have extreme worst case vehicles available at the appropriate time. As a result, an allowance (tolerance) is allowed on the value actually tested by the Technical Service for the test report and test data provided by the system supplier which is used to set the wheelbase limits for which the test report can be used.

- Wheel type and tyre type

It is not possible to test all wheel and tyre type combinations, nor is it possible to control what is actually fitted to the vehicle when the vehicle is in service. As a result, the control logic has to be robust enough to cover such possibilities and, therefore, any limitations are as given in the information document.

- Track width

  While track width will influence the roll-over potential of a vehicle, it is subservient to the centre of gravity height. Once the resultant force of the vehicle weight and its centrifugal force acting at the centre of gravity, acts outside the effective track (the outer limit of the tyre/road surface interface) the vehicle will roll-over. Therefore, track width is not evaluated as a separate characteristic.

- Suspension type

  Similar to track width, the type of suspension is subservient to the centre of gravity height. Therefore, suspension is only evaluated on the basis of basic type, i.e. air, mechanical, rubber.

- Centre of gravity height

  The centre of gravity height is a variable during the operation of a vehicle due the amount and type of load and, therefore, it is to be shown that the vehicle stability function can automatically adapt to changes in centre of gravity height.

  While it is possible to adjust the centre of gravity height of a vehicle, it can be a major logistic problem to have an extreme worst case vehicle available at the appropriate time. As a result, an allowance (tolerance) is allowed on the maximum value actually tested by the Technical Service for the test report and test data provided by the system supplier which is used to set the maximum centre of gravity height for which the test report can be used.

- Lateral acceleration sensor position/yaw rate sensor position

  The positioning of individual sensors or a combined sensor can influence performance and, therefore, the installation envelop specified by the system manufacturer in the information document is to be evaluated to demonstrate conformity.

- Loading

  As vehicles are operated under differing conditions of load, testing is required in the laden and unladen/part laden conditions.

  In the case of semi-trailer tractors, the semi-trailer is influential in the performance of the system and, therefore, laden and unladen/part laden test are carried-out with a semi-trailer attached. A specific semi-trailer is not specified as there is no control of the semi-trailers that will be used in service. The control logic has to be sufficiently robust to cope with all possibilities. The tractor alone (solo without any additional

weight representing a semi-trailer) is also required to be evaluated as this is a possible operating condition.

Annex 20:

……. (content to be added)

Annex 21:

Vehicle type ……. (content to be added)

Simulation …… (content to be added)