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Inland Transport Committee

Working Party on the Transport of Dangerous Goods

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Item 5 (a) of the provisional agenda

**Proposals for amendments to annexes A and B of ADR:
construction and approval of vehicles**

Testing endurance braking performance for vehicles with re-generative braking systems

Transmitted by the Government of the Netherlands

Introduction

1. ADR motor vehicles with a maximum mass exceeding 16 tons or motor vehicles authorized to tow a trailer with a maximum mass exceeding 10 tons are required to have an endurance braking system of the Type IIA.
2. To cover re-generative braking systems UN Regl. No. 13 is updated recently (supplement 18 of the 11 series of amendments). For endurance braking systems new tests have been introduced. For vehicles with traditional “friction” brake systems only, it is not allowed to use the service-, secondary- or parking brakes for meeting the type IIA endurance brake requirements.
3. However, for vehicles with re-generative braking systems two tests are foreseen to be passed, one test with batteries with sufficient capacity left to store the generated electrical energy, and a second test when the state of charge is such that electrical energy cannot be stored and the service brakes shall be used, meeting minimum deceleration figures of hot brakes at the end.
4. When originally introducing the endurance braking system in the ADR, it was the intention not to rely on the service brakes on long descents. However, as technology develops it should be re-evaluated. For this reason, the Netherlands seeks the opinion of WP.15.

Discussion

5. Discussion point 1, where two principle positions may be taken:
 - (a) We do not want to rely on service brakes (friction type) on long descends and the endurance brake, by re-generative braking, shall function regardless of the state of charge of the batteries.

The consequence of this approach is to amend ADR 9.2, Annex 4 or 5 of UN Regl. No. 13.
 - (b) On long descends we will have redundancy of two separate systems, when re-generative performance is not effective due to the state of charge of the battery, it is required to have a back-up in service “friction” brakes.

The consequence of this approach is that no changes are needed.
6. Discussion point 2 :
7. When using the service brakes (see 5 (b) above) as backup of the re-generative braking system on transport units consisting of a towing vehicle and a trailer, the performance of the endurance braking system shall be delivered by:

- (a) The towing vehicle only; or
- (b) The towing vehicle and the trailer?

Background and way forward

8. The Type IIA test requires a loaded transport unit to maintain a speed of 30 km/h during a descent of 7% slope, for 6 km. The maximum mass of transport unit is up to 44 tons for ADR vehicles.

9. The application of endurance brakes was introduced after an accident in Germany where the service brakes failed on a descent of a truck downhill, loaded with liquid fuels, leading to a considerable loss of life.

10. When service brakes based on friction are applied, heat develops that may reduce the efficiency of the friction material and finally may lead to a total loss of performance due to changes in the material.

11. On motor vehicles with traditional “friction” service-, secondary and parking brake systems, the endurance braking system consists of a hydraulic or electric device in the driveline (retarder) or an engine that could deliver the required performance. The service-, secondary- or parking brake were not allowed to be used in UN Regl. No. 13 to achieve the required performance.

12. Recent changes in UN Regl. No. 13 to include re-generative braking also changed the way the performance of the endurance brake function may be achieved. When the batteries are fully charged the re-generating stops and as a consequence the braking performance of this system stops. When this happens, the service brake system is allowed to be applied to make up for the lost performance. In the new regulation notes are made of the use of route planners to plan ahead for long descents to have sufficient storing capacity in the batteries, but this is no guarantee.

13. On Battery Electric Vehicles and Hydrogen Fuel Cell Vehicles the motors acts as generators when being driven by vehicle motion. In the IWG-EV a liquid cooled electrical resistor was envisaged to convert electrical energy, by re-generative braking, into heat in the case the batteries would be fully charged. It was at that time expected to change all re-generated electrical energy in to heat, to be dissipated to the vehicle cooling/heating system.

14. There is urgency to answer these questions to help the approval of ADR Battery Electric Vehicles for the AT category.
