

JRC input to the flooding test proposed in TF1 "Protection against water" of EVS GTR

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At the 8th EVS GTR meeting held in June 2015 in Washington (USA), TF1 "Protection against water", led by China, has proposed a "flooding test" (EVS-08-17e). The proposed test parameters, e.g. water depth, vehicle speed and distance, have been discussed in detail during the TF1 meeting prior to the 9th EVS GTR meeting held in September 2015 in Changchun (China), but no agreement has been reached due to a lack of data.

This document summarizes data and information gathered by DG JRC on certain aspects of the proposed "flooding test". In order to evaluate to what extent the proposed flooding test conditions are relevant to real situations, relevant external parties were consulted and relevant field data was collected for a number of EU Member States.

Data collected:

1) To evaluate how often and to what extent traffic experiences hindrance due to standing water on the roads in the Netherlands, Rijkswaterstaat has been consulted.

Rijkswaterstaat, as part of the Dutch Ministry of Infrastructure and the Environment, is responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands. These include the main road network (highways), the main waterway network (e.g. canals and rivers, waterways in open water, locks and bridges) and water systems (e.g. major rivers, coast, the Wadden Sea, the Southwest Delta, the IJsselmeer region and the North Sea) (for more information please see <http://www.rijkswaterstaat.nl/English/>).

From exchanges with Rijkswaterstaat it appears that 10 cm of water may be relatively easily formed on Dutch secondary roads and in tunnels under railways and viaducts. These roads are less often closed and, therefore, it is the usual practice to drive, albeit at a lower speed, through flood water. Also, 10 cm of water on a highway is less frequently but regularly (approximately 1 to 3 times a year) observed in The Netherlands. This usually happens after heavy rain or when rivers flood. Then the affected lanes of a highway maybe closed. Please see a full summary of the discussion in Annex I.

Also, to illustrate the statements made above, Rijkswaterstaat has kindly provided links to the movies available on YouTube that show day-to-day situations in the Netherlands when roads are flooded:

a) <https://www.youtube.com/watch?v=1AgxJH6g0bA>

Additionally, the following movies are also illustrative:

b) <https://www.youtube.com/watch?v=KFzYsaGGiSk>

c) <https://www.youtube.com/watch?v=vVawRxXqZtE>

d) <https://www.youtube.com/watch?v=z1qAH2otlYs>

2) The Automobile Association (AA) in the UK does not recommend entering flood water that is moving or more than 10cm (4 inches) deep (http://www.theaa.com/motoring_advice/seasonal/floods-and-wet-weather.html) and advises to only drive through water if it is known that it's not too deep - generally this

would mean no more than halfway up the wheels (http://www.theaa.com/motoring_advice/seasonal/flood-water-dangers.html).

In Ireland the AA similarly recommends avoiding driving in moving water above 4 inches (10cm) or six inches (15 cm) of standing water (<http://www.thejournal.ie/driving-through-floods-seven-tips-road-safety-flooding-ireland-502596-Jun2012/>).

The UK's Driver Training Organisation "SmartDriving" warns: "If you intend to drive through a flooded section of road, your first task is to check the depth of the water. In normal vehicles you should never attempt to drive through water that is more than about 25 centimetres deep (or up to the centre of your wheels)." (http://smartdriving.co.uk/Driving/Driving_emergencies/Floods.htm)

3) With climate changing, it is expected that in the future floods in certain areas of Europe will become more frequent and/or severe. The challenges associated with this have been reviewed and addressed in a number of the EC funded projects (e.g. the Coordination Action "ERA-NET ROAD - Coordination and Implementation of Road Research in Europe",

http://www.eranetroad.org/index.php?option=com_content&view=article&id=76&Itemid=79).

In the frame-work of the Coordination Action, the project SWAMP "Storm Water prevention - Methods to Predict Damage from the Water Stream in and near Road Pavements in lowland Areas" has developed and presented the methodology to evaluate the location, extent and duration of potential floods in Denmark (see http://www.eranetroad.org/index.php?option=com_docman&task=doc_download&gid=183&Itemid=53).

Conclusions:

Considering the above-reviewed evidence it is reasonable to expect that electric vehicles may be driven through flood water in The Netherlands, UK and Ireland.

The proposed parameters of the "flooding test" do not seem to be excessively stringent and are, in general, representative for realistic situations reviewed

ANNEX I

Ms. Ellen Moens, Senior Advisor/Crisis coordinator, Rijkswaterstaat
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Teleconference

A question regarding closing the roads in the Netherlands due to water hindrance, asking specifically at what water depth on a road surface is the road closed, was recently sent to Rijkswaterstaat. At the beginning of the teleconference Natalia Lebedeva explained the background of the question: a Global Technical Regulation for Electric Vehicles Safety is being currently prepared as part of the effort for global harmonization of the regulations¹.

One of the tests proposed for electric vehicles within the EVS GTR is a so-called "flooding test", where an electric vehicle drives through a trough filled with water. The proposed length of the trough is 500 m and the proposed water depth in the trough is 10 cm. The question is how realistic and representative this test is for the situations observed on the roads in The Netherlands?

Ellen Moens explained that Rijkswaterstaat controls and manages only the highways ("snelwegen") in The Netherlands. Local roads ("onderliggend wegennet met o.a. provinciale wegen") are under control of local authorities.

In general, it is the traffic safety and not the depth of the water on a highway that determines whether the road is (partially) closed or not. One of the parameters to consider is here the risk for aqua-planing.

Nevertheless, 10 cm-thick water layer on a highway is regularly (approximately 1 to 3 times a year) observed in The Netherlands. This usually happens after a heavy rain due to a limited capacity of the water-removing ditches ("kolken") along the roads or when the rivers flood. Then the affected lanes of a highway maybe closed. One of the highways known to be prone to flooding in A20 near Gouda.

Also, up to 10 cm of water may relatively easily be formed on the secondary roads and in the tunnels under the railways and viaducts ("viaducten "). These roads are less often closed because most of the times it takes more time to determine where the flooding problems are and take measures to close these roads, then the time that the flooding is actually there. And therefore it is the usual practice to drive, albeit at a lower speed, through the puddle of water.

Thanks to the fact that a so-called "zeer open asfaltbeton²" is used in approximately 90% of the highways in The Netherlands, the issues related to accumulation of water on the highways are not frequent. It is expected that some neighbouring countries such as Belgium, Germany and France may in some places experience more hindrance due to accumulation of water on the highways as "zeer open asfaltbeton" is less often used there.

Also secondary roads in The Netherlands are usually not paved with "zeer open asfaltbeton" and are, therefore, less efficient in water removal from the road's surface.

¹ see <https://www2.unece.org/wiki/pages/viewpage.action?pageId=3178628>

² Porous asphalt