Why Bulk Liquid Cargoes Shall Be Secured For Safe Transportation In Mobile Tanks.

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Abstract

Bulk liquid cargoes have not been secured in mobile tanks primarily because the significance of improving the safety of liquids transportation using means to secure liquid cargoes which include the elimination of any dynamic behaviour of liquids during transportation, had never been established nor fully been realised. Secondly, no bulk liquid load securing means were developed nor become available to bulk liquid transportation companies.

Research, recently concluded at the University of Twente, the Netherlands, not only provides for bulk liquid slosh mitigating and securing means but also has demonstrated the need for applying such means. (Eenkhoorn E.J., 2017).

Details

Bulk liquid cargoes should be secured just like tree-trunks or boxes with cans of apple sauce are to be secured before transporting these. Vehicle legislation stipulates that the vehicle must have a braking system in addition to the engine that can and does absorb all energy from the vehicle and the load during deceleration. However, this is not happening in bulk liquid transport. Liquid cargoes are required to lose their energy, during tank truck braking and after this tank truck having come to a stand-still, by dampening in a sloshing process. The (kinetic) energy of a liquid charge is therefore not absorbed by the brakes (nor by the engine) during braking nor after having come to a stand-still of the mobile tank. The dampening of liquid can be increased by using baffles. Baffles however, not only during braking but continuously dampen and thereby mainly result in a higher and unnecessary diesel consumption of the tank truck. The energy lost by dampening the liquid requires to be re-supplied by the engine of the truck resulting in the higher diesel consumption. In addition, baffle baffles do not offer any lateral stability, and this is precisely the direction in which (tank) trucks keel-over. (Eenkhoorn E.J., 2017).

Figure 1. First “ADR” (see Reference) tank-truck with liquid load securing “Cairbag©” system in Germany

When bulk liquid cargoes are secured, the driver has the possibility of maximum braking in emergency situations, with a deceleration in accordance with the law stipulated for that purpose. Now, he or she brakes intuitively based on experience gained with driving tank vehicles and based on own confidence in still being able to control the vehicle and load and movements thereof. Subject to the experience of the driver, this leads to braking distances which are unnecessarily too long, especially, as researched, when ABS braking systems are also used on the tank vehicle. This is assumed to contribute to sometimes very serious head-tail collisions.

Liquid load securing was proven by referenced research to mitigate the risk of keeling-over of a mobile tank. Furthermore, the brake performance of mobile tanks is significantly improved by securing the liquid cargo. The reduction of fuel consumption when liquid loads are secured is not only economically attractive but also makes liquid transportation environmentally sustainable.

The scientifically incorrect "baffle plate" regulation in the international legislation for transportation of Dangerous Goods by Road, mostly based on the UN guidelines thereto will therefore be recommended to be corrected in a presentation to the UN “Tank Working Group” on 19 September 2018, as:

- The UN guideline on which for example the European Law on "Transportation of dangerous goods by road", the "ADR" is based, to state in Article 4.3.2.2.4 that:

  "Liquid cargoes which only partly fill the mobile tank in which they are transported must be secured in accordance with Article 7.5.7.1".

- Similarly, ”load-securing” as specified in article 7.5.7.1 is recommended to be corrected into:

  “All loads shall be secured.”

  Possibly with the addition of:

  “Such securing shall be done prior to commencing the transportation”.

Liquids that do not resort under legislation based on the UN guidelines for transportation of dangerous goods are recommended to be treated identically to liquids that must comply with such legislation as the dynamics of a liquid being transported are not subject to such liquids being “flammable” or “toxic”.

The immediate “tolerating” of scientifically justified, liquid cargo-securing solutions will also be proposed for formal ratification by the UN “Tank Working Group” through “interpretation clarifications” of the current relevant articles of the UN guidelines for transportation of dangerous goods.

References

Eenkhoorn, E.J. (2017). *Products to mitigate liquid sloshing*, University of Twente, Enschede, The Netherlands. ISBN 978-94-6233-808-1.

United Nations Economic Commission for Europe, *European Agreement concerning the International Carriage of Dangerous Goods by Road (“**ADR**”)*, Geneva, 30 September 1957.

Note 1: Ausstralian reference: Australian Code for the Transportation of Dangerous Goods by Road & Rail, published by the National Transport Commission.

Note 2: ”ADR” does not refer to: Australian Design Rules for motor Vehicles and Trailers.