ROAD TRHYP

ROAD trailer design - Use of **T**ype V the**R**moplastic tubes with light composite structure for **HY**drogen trans**P**ort

D4.3 Recommendations for interoperability between type V trailer and HRS reported to ISO WGs

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Clean Hydrogen Partnership

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Content

Technical abstract

Context: The overall ambition of the ROAD TRHyP project is to demonstrate that a trailer made out of thermoplastic composite tubes (Type V) is a suitable solution to improve the GH_2 supply chain: ROAD TRHyP aims at maximising the amount of H_2 transported while satisfying end-user requirements (safety, ability to be decontaminated, low TCO, reduced environmental footprint) and enforced regulations. WP4 focuses on the regulatory aspects, intending to pave the regulatory environment (standards, legislation) to facilitate the implementation of the developed trailer and reduce its time-to-market.

Results & conclusions: some subjects were identified through the first stage of the WP (adapted rules and standards for type V cylinders and enhanced-capacity trailers, extension of the regulatory text to the special context, interoperability of the solution with the trailer). It was expected to be complemented with the different outcomes of the project (e.g. final design of the cylinders and the innovative trailer, results of the bonfire test, permeation test), but some of the project tasks are still ongoing and should be finalized in the coming months. As a consequence, the technical topics that can be discussed with the identified standardization and regulatory organizations cannot be currently enriched with practical data and issues.

Perspectives: as the relevant organisations of interest have been identified, they can be easily contacted if some planned project outcomes can be achieved (bonfire test at Efectis test facility, cycling test…).

I. Introduction

This report has been prepared to meet the requirements of ROAD TRHyP project deliverable 4.3.
This report consists of several main sections as follows :

- Stage setting: motivation, goal.
- Reminder of the identified topics to be discussed.
- Identified organisations to contact.

II. Stage setting

A. Motivations

Compressed hydrogen can be transported currently by trucks in gas cylinders or gas tubes with pressures between 200 and 500 bar. Usually, several cylinders or tubes are bundled to modules in a 20′ or 40′ container that is mounted on a trailer (tube trailer). Typically, the high weight of the cylinders or tubes limit the maximum hydrogen load that can be transported. A tube trailer with steel cylinders can store up to 25,000 litres of hydrogen compressed to 200 bars, which amounts to around 420 kg of hydrogen. However, the latest tube trailer with carbon fibre cylinders, one of its kind, can store up to 1.3 tons of hydrogen compressed to 500 bars.

Lighter tank materials (composite materials for gas cylinders or gas tubes) that can be operated at higher pressure must be developed in order to increase the hydrogen quantities transported per trailer. Existing trailer transportation solutions mainly use tubes with a working pressure between 200 bar and 300 bar but are not efficient in terms of quantities or cost to address large refuelling stations with ramp-up of vehicles. The development of a supply chain with higher pressure and more disruptive technology is needed and type V tube technologies (thermoplastic composite without liner) must be investigated for its capacity to answer the different areas of concern identified hereunder.

The CH JU call Horizon JTI-CH-2022-02-07 identified the following areas of concern that served as a motivation for the ROAD TRHyP project:

- Reduce the cost and the environmental footprint of transporting compressed hydrogen;
- Decrease the number of transport rotations between the site of production and the delivery site;
- Decrease the compressor size at the hydrogen refuelling station (HRS);
- For the GH_2 logistics, improve the cost and quantities transported;
- For the HRS capability, improve the delivered capacities and reduce the cost of the molecule at the nozzle by increasing the quantities available.

The overall ambition of the ROAD TRHyP project is to demonstrate that a trailer made out of thermoplastic composite tubes (Type V) is a suitable solution to all of the above-mentioned topics. ROAD TRHyP aims at maximising the quantity of H_2 transported while satisfying end-user requirements (safety, ability to be decontaminated) and enforced regulations, with a low TCO.Lorem ipsum dolor sit amet

B. Goals of the RCS analysis

In order to protect the people and goods, the design, manufacturing and use of compressed gas solutions are heavily regulated by international (e.g. RID/ADR), EU (e.g. TPED) regulations and ISO (International Standard Organisation) and CEN (European Committee for standardisation) standards. The new technical innovative solutions developed within ROAD TRHyP may not be covered by existing standards and regulations.

Therefore, within the project, it should be identified if the proposed solutions (type V cylinders, high pressure) are covered by existing standards and/or regulations. If gaps are identified, they have to be listed here and relevant activities that should be performed to fill these gaps are listed.

In a first stage, the current legislative and standard environment has been analyzed. This review focused on both the trailer with the type V cylinders and their ancillaries (D4.1) and the hydrogen refuelling stations (D4.2). In this second step, actions to monitor regulatory developments and as necessary and relevant, participation in working groups focusing on this topic was planned.

III. Reminder of the identified RCS gaps

In the previous stage of the project, different gaps had been highlighted through the RCS review and the interviews of stakeholders:

- Lacks restraining the large-scale deployment of the solution:
  - Inclusion of the type V cylinder technology in the dedicated standards. The identification of the most relevant standards for this technology and this application has to be discussed with the different technical committees;
  - Definition of protocols to calculate safety distances better-suited with every situation (type of trailer, operating pressure, presence of safety devices like shutoff valves or breakaways…).

- Weak harmonization of the rules between geographies:
  - Current safety distances are only specified by local regulations and are not adapted to the context;
  - Trailer acceptable characteristics are variable in Europe (in terms of size or weight);
  - Minimal requirements in terms of safety equipment to be implemented on the trailer.

- Interoperability between hydrogen refuelling stations and trailers (standardized couplings, generalized equipment to allow the transfer under various operating pressures).

IV. Identified organizations to contact

Eleven organizations with potential contacts have been identified. They can be sorted into three categories:

- Certification organisms (Bureau Veritas, TUV, Ineris, DNV, APAVE): these organizations are solicited to share about the know-how in terms of risk management (support for the definition of adapted safety distances, list of the safety devices and protocols to make mandatory or recommended) and the developed knowledge on the main points of attention regarding safety and handling.
- Standardization organisms (CEN, AFNOR, NBN): the exchanges will mainly concern the way to add the type V cylinder technology in the standards (identification of the better-suited standards for the application and exchanges on the requirements regarding the design, handling, processes, testing and maintenance). It will also tackle the ways to improve the interoperability with stations and to spread these solutions. Finally, discussions will deal with the harmonization of safety distance assessment and the dissemination of good practices.
- Potential or current stakeholders (Kiwa, Calvera Hydrogen): the goal is to share their opinion on the technical solutions related to the equipment (trailer design, cylinders ancillaries, safety devices to make mandatory, good practices to spread) and the way to optimize the interoperability of the equipment.

First contacts have been established, but suspended waiting for the more outcomes of the project. These outcomes are related to the trailer and cylinder designs, to the test results (behaviour when submitted to a bonfire, actual tank permeation, burst cycling and more generally cylinder performances according to tests described in relevant standards) and to necessary operational protocols (decontamination tests procedures…).

V. Conclusions

If some topics of interest have been identified in the work package, they are currently generic and could also be valid for innovative designs of trailers or type IV cylinder technologies. Some of the main technical specificities related to the type V tank technology, that the project aimed to highlight, have still not been fully completed (e.g. the performances of Type V cylinders still need to be improved especially at 700 bar working pressure). This makes the formulated recommendations and the interviews with the targeted organisations less relevant for the moment: the exchanges would hardly differ from the ones achieved with stakeholders in the first part of the work package. For this reason, the discussions have been postponed.

In the coming months, the experience gained during the preparation step and the realization of the bonfire test (high-pressure H2 filling, temperature diffusion across the wall, warning signs for material degradation…) and the other tests on the final design of the cylinder, all planned in S1 2026, can be used to identify the most hazardous steps in the handling of this technology and the priority topics to share.