

HyTunnel-CS

PNR FOR SAFETY OF HYDROGEN DRIVEN VEHICLES AND TRANSPORT THROUGH TUNNELS AND SIMILAR CONFINED SPACES



Project ID:	826193
PRD 2023:	Panel 5 – cross-cutting
Call topic:	FCH-04-1-2018: PNR for safety of hydrogen driven vehicles and transport through tunnels and similar confined spaces
Project total costs:	EUR 2 500 000
Clean H₂ JU max. contribution:	EUR 2 500 000
Project period:	1.3.2019–31.7.2022
Coordinator:	University of Ulster, United Kingdom
Beneficiaries:	Commissariat à l'énergie atomique et aux énergies alternatives, Danmarks Tekniske Universitet, Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón, Health and Safety Executive, International Fire Academy, Karlsruher Institut für Technologie, National Center for Scientific Research 'Demokritos', Pro-Science – Gesellschaft für Wissenschaftliche und Technische Dienstleistungen mbH, Service Public Fédéral Intérieur, Stichting Koninklijk Nederlands Normalisatie Instituut, Università degli Studi di Roma la Sapienza, Universitetet i Sørøst-Norge

<https://hytunnel.net>

QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Target	Achieved to date by the project	Target achieved?
Project's own objectives	D5.4 Harmonised recommendations on response to hydrogen accidents	1	1	
	D6.10 Recommendations for RCS	1	1	
	D6.9 Recommendations for inherently safer use of hydrogen vehicles in underground traffic systems	1	1	
	Engineering models and simulations	34	34	✓
	Two seminars (M6, M30), two workshops (both M15), dissemination conference (M36).	5	5	
AWP 2018	Unique experimental data / experimental data to support development of physical models, simulations and engineering tools	20	20	

PROJECT AND OBJECTIVES

This pre-normative research project aimed to improve the safety of hydrogen-driven vehicles in underground infrastructure. HyTunnel-CS aimed to synthesise analytical, numerical and experimental research to produce recommendations for intervention strategies and tactics for first responders, recommendations for the safer use of hydrogen vehicles in underground transportation systems and recommendations for regulations, codes and standards (RCS). The project also aimed to reduce overconservatism in infrastructure safety design for hydrogen accidents and to reduce the costs of underground systems. The outcomes can be directly implemented in relevant RCS.

NON-QUANTITATIVE OBJECTIVES

The project aimed to ensure that fuel cell electric vehicles entering tunnels are at a level of risk equal to / below that of fossil fuel vehicles. This was addressed by considering tunnel vehicles as a system through experimental, theoretical and numerical studies.

PROGRESS AND MAIN ACHIEVEMENTS

The project achieved all objectives and milestones.

- Work on the state of the art in safety provisions for underground transportation systems and in prioritising accident scenarios was completed in the first reporting period, with all public deliverables being achieved. This work formulated problems and prepared the field for pre-normative research in work package (WP) 2–WP5 (all publicly available on the project website).
- Analytical, numerical and experimental pre-normative research in WP2–WP4 started with the development of detailed research plans, reported in deliverables 2.1, 3.1 and 4.1. The work performed in WP2–WP4 from the beginning of the project to its end was reported in deliverables 2.3, 3.3 and 4.3 (final report on analytical, numerical and experimental studies for each work package). Most analytical and numerical research plans have been completed in a timely manner, sometimes ahead of the schedule (e.g. engineering tools in deliverable 4.2). The experimental studies were affected by the COVID-19 pandemic but mostly recovered during the 5-month extension period. Experimental work at the

Health and Safety Executive suffered from off-design test conditions at a large-scale tunnel facility, but was completed in December 2022 (final reports on deliverables 2.3, 3.3 and 4.3 are available on the project website) (relevant Innovation Radar entry: <https://www.innoradar.eu/innovation/40447>).

- All deliverables in WP5 (first responders' intervention strategies and tactics for hydrogen accidents in underground transportation systems and risk assessment) – deliverables 5.1, 5.2, 5.3 and 5.4 – have been achieved on time and are publicly available on the project website. The stakeholder workshop (milestone 6.2) and the international workshop of emergency services (milestone 5.2 and deliverable 5.2) were changed from face-to-face to online events due to the COVID-19 pandemic (reports on deliverables 5.3 and 5.4 are available on the project website) (relevant Innovation Radar entry: <https://www.innoradar.eu/innovation/40450>).
- WP6 (synthesis, outreach and dissemination) was responsible for the two principal project outcomes – deliverables 6.9 (recommendations for inherently safer use of hydrogen vehicles in underground traffic systems) and 6.10 (recommendations for RCS). National networks and a stakeholder advisory board were formed and operated within WP6. The board meeting minutes are reported in deliverables 6.2, 6.4, 6.6, 6.7, 6.8 and 6.13. The list of publications was compiled and maintained as part of milestone 6.5 (report 6.9, deliverable 6.10 and the publication list are available on the project website).
- The safety strategies developed in the project, the closed knowledge gaps and the main public outcomes (deliverables 5.4, 6.10 and 10) were presented at the dissemination conference (deliverable 6.12), which was organised as a face-to-face event on 14–15 July 2022 in Brussels (all conference presentations are available on the project website).

FUTURE STEPS AND PLANS

- The project completed its work.
- Final periodic and financial reports were submitted.
- Partners continue to communicate the project results through scientific publications and at the meetings of standardisation organisations.