The Institution of Engineering and Technology

Advancing safety in transport through automation

How a cross-modal approach will ensure a positive impact

Looking at the four transport modes - road, rail, maritime and air - we examine potential approaches to advancing safety in transport through automation. We review their current approaches to safety and risk and cover the expected impact of automation on safety. The transport sector is actively pursuing the benefits in cost, safety and flexibility from the technology behind semi and fully autonomous vehicles. These autonomous systems all share the same basic system architecture and are dependent on the need for high integrity decision-making software. Therefore, there is an opportunity to share knowledge and costs across the sectors, which may speed up development. There are also benefits to taking a common approach to safety to advance public acceptance.

Road

Automation is widely expected to have positive results for safety in the road sector. This is because it partially or fully takes control away from the driver, which accidentology shows is a major risk factor. The form of accidents – such as type or road users involved – may also change. There may be an increase in crashes caused by technical faults with automated vehicles, but this is expected to be more than offset by a reduction of crashes caused by poor driver behaviour.

Rail

Automatic train control offers the possibility of improving the efficiency of the control of the movement of trains on the network by removing the variabilities of human driving and by eliminating human error. This gives the opportunity to increase capacity, reduce energy usage, eliminate availability of staff as a cause of train delays and lower the overall cost of running the railway. At the same time consideration must be given to the impact on safety.

Maritime

The fast pace of change in maritime autonomy demands updated and relevant guidance for those owning and operating maritime autonomous surface ships. Under the International Maritime Organisation (IMO), the 98th session of the Maritime Safety Committee (MSC 98) agreed to work on a regulatory scoping exercise for the use of maritime autonomous surface ships (MASS), with a target completion year of 2020, but this is still underway.

Air

Automation not only has the potential to further improve the safety of aircraft, but also to extend the use of aircraft in undertaking dull, dirty, and dangerous activities. The rapidly developing interest in urban air mobility will also require high levels of automation to meet safety and affordability requirements.

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Recommendations

The development of autonomous transport systems brings new challenges. This includes assuring safety in the design and operation of the systems, but it also provides an opportunity to improve safety across all four sectors: road, rail, maritime and air.

Vehicle/vessel safety is only a part of overall safety when it comes to automated vehicles. The focus needs to be on system safety and we need to take full advantage of cross-modal learning and standardisation of approaches. By promoting a common approach to safety analysis and standards, the transport industry will be able to share scarce specialist resources.

1. **Department for Transport (DfT) annual UK transport statistics should include a suitable cross-modal comparison of risk and safety**. This needs to be properly researched and could involve multi-year average death rates and other data in comparable and relevant units.

2. **Invest in approaches to validate/verify data sets for artificial intelligence-based (AI) systems (training and operational) and qualification of AI safety-critical applications**. This should include a national infrastructure that enables the collection, dissemination and use of data sets drawn from all sectors, as well as establishing international collaboration. This data could be used for research and to inform standards development.

3. Rail, air and maritime all have investigation branches which have contributed massively to safety improvements over the years. Road has no such function and this has to change as automotive moves towards autonomy, or many lessons will be lost. **DfT should establish a road accident investigation branch to bring together expertise in vehicle crashes**.

4. **Establish a cross-modal working group to develop a new standard for the functional safety of programmable safety-related systems**. Recognise that management and maintenance of these complex safety-critical systems will be at least as challenging as their initial design and establish requirements and infrastructure to ensure safety is maintained throughout a system's life.

5. Cyber security is becoming increasingly important in most modes of transportation, particularly as automation and connectivity grows. Therefore, **relevant standards should be reviewed for their suitability and adequacy**.

6. **Invest in further research on the public perception of autonomous systems**. This will build trust through the design and development of inclusive solutions that increase adoption, and address concerns around negative impacts of autonomous systems.

For further information and to read the full report, visit theiet.org/autonomy-in-transport

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