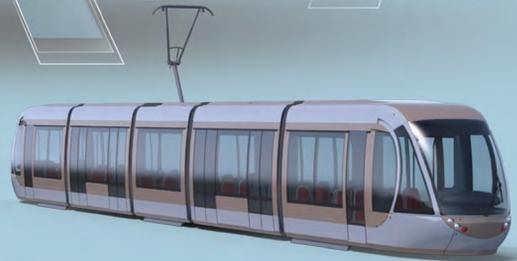


Cooperative, Connected and Automated Transport



Roadmaps



In Brief

Connected and automated transport (CAT) technologies can contribute to increasing the efficiency and safety of the transport system. They can improve traffic flows, optimise infrastructure and public transport usage and foster multi-modal transport solutions.

Although a number of pilot demonstrations of CAT technologies are taking place in Europe, there is still a need for large-scale testing to determine the technological readiness, reliability and safety of automated transport functions in complex situations.

This will require addressing key issues such as the performance of innovative automated transport technologies, a regulatory framework which supports deployment of CAT solutions and technologies, acceptable levels of cybersecurity, as well as new business models.

The Strategic Transport Research and Innovation Agenda (STRIA) Roadmap for *Cooperative, Connected and Automated Transport* defines future research needs for developing and deploying CAT technologies and systems for all transport modes

Current Developments

Road: Many car and truck manufacturers are developing and rolling out vehicles with higher automation. An increasing number of European cars are already equipped with partial automation technologies, and the next step is the introduction of vehicles where the driver can choose whether to drive or not. Automated trucks and truck platooning are being tested on motorways in Europe. User-friendly automated public transport concepts have been demonstrated. Connectivity enables and will further expand automated vehicle performance by making distributed information and big data accessible.

Aviation: CAT technologies are being introduced in the civil conventional aviation sector. Smarter avionics systems are being integrated into the cockpit with increasing automation. On-board automation can provide greater levels of safety and predictability. Data connectivity in air transport is however developing at a slower pace. Connectivity offers new services to passengers and innovative ground processes that contribute to developments for increasing efficiency and reducing carbon dioxide emissions.

Waterborne: Ship automation is well advanced with most modern ships and vessels being equipped with systems such as target detecting radars, autopilots and track pilots using satellite positioning. Some autonomous ship demonstrations have been made, but technology is still on a low readiness level. Safety is a main area where automation is expected to provide improvements, e.g. by allowing to further address the human factor. Better data integration and improved monitoring will allow CAT to contribute to a competitive European shipping industry and improve security in the transport systems. However, digital Connectivity is a prerequisite for further improvements to increase capacity and coverage.

Rail: CAT technologies are already embedded in rail-bound transport such as metro systems, in some cities also automated driverless rail-bound systems can be found. However, due to a diversified European rail sector the implementation of CAT technologies is slow and lowers competitiveness. The Strategic Rail Research Innovation Agenda and related roadmaps for various parts of rail-bound systems as well as the multi-annual action plan of the *Shift2Rail* initiative address several aspects of automation and connectivity.

Key Research Innovation Pathways

The CAT roadmap focuses on eight actions that will develop technologies and support their swift deployment while ensuring competitiveness. This will provide a framework that contributes to the decarbonisation of the European transport sector allowing EU energy and climate targets to be met.

1. Active management of CAT technologies

The running of automated and non-automated systems in parallel is essential for the successful deployment of CAT. Transition principles will have to be developed between existing and future solutions, for each transport mode and the integrated transport system as a whole.

2. User and societal acceptance

Targeted research for user needs and requirements based on real-life applications in a variety of settings is needed. It is necessary to develop acceptance criteria for operation of different types of autonomous vehicles, including users' confidence when no "driver" is present. Novel data sources together with analytics can be key enablers.

3. Socio-economic impacts

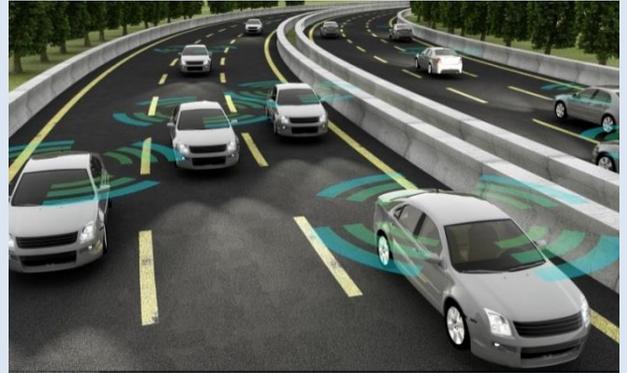
Increased automation and connectivity in the transport sector will require an analysis of associated socio-economic impacts. The social perception and acceptance of automation should be considered for a transition towards higher adoption rates as well as monitoring of the potential impact on jobs both within Europe and worldwide. Training and education considerations will also need to be examined.

4. Environmental and climate impacts

For the environmental and climate impact of these technologies it will be important to anticipate and assess how they influence mobility behaviour and what carbon dioxide emissions and resources effects it entails.

5. Human-machine interface

New ways to design the human-machine interface in the vehicles/vessels will remain an important field of research. There is potential to exchange between transport modes experiences and best practices in this area.



6. Innovative hybrid vehicles

Big data, automation and connectivity enable innovative hybrid vehicles. However, these new vehicles may not fit into the rigid definition of current modes in terms of underlying infrastructure, propulsion, or loads being carried. These vehicles will need further attention in terms of research and innovation, standards and regulations.

7. Cybersecurity and data protection

There is a need for greater research understanding of transport cybersecurity and the identification of related risks associated with implementing adequate security. Acceptable levels of, and principles for, cybersecurity and data protection need to be developed and regularly updated. European guidelines and measures also need to be developed to prevent unauthorized access to data from vehicles/vessels and infrastructure.

8. ICT infrastructure

Vehicle connectivity is essential to increase the safety and performance of CAT technologies and development of cost-efficient and reliable connectivity solutions must be supported. There is a need to coordinate investments towards reliable communication coverage and to exploit the full potential of hybrid communications.

9. Optimised use of internet of things, data and governance

Research is needed to increase the performance and efficiency of automated transport technologies, transport systems, mobility and freight delivery services. This includes data mining, access to and innovative uses of data sources, data analytics, innovative business models, and visualisation. It is also necessary to define technical specifications that can enable applications over variable quality of service data networks and also in remote areas.



Transport Research and Innovation Agenda

The Strategic Transport Research and Innovation Agenda (STRIA) outlines future transport research and innovation priorities to decarbonise the European transport sector.

STRIA is one of five interlocking dimensions set out in the Energy Union strategy that provides a framework to achieve EU energy and climate goals. It supports the vision of a clean, connected and competitive European transport system.

In coordination with Member States and transport stakeholders, STRIA aims to set out common priorities to support and speed-up the research, innovation and deployment process leading to radical technology changes in transport.

STRIA builds on and integrates seven thematic transport research areas:

- Cooperative, connected and automated transport;
- Transport electrification;
- Vehicle design and manufacturing;
- Low-emission alternative energy for transport;
- Network and traffic management systems;
- Smart mobility and services; and
- Infrastructure.

STRIA is also the interface between other relevant sectors such as energy and information and communication technology.

About TRIMIS

The Transport Research and Innovation Monitoring and Information System (TRIMIS) supports the implementation and monitoring of STRIA and its seven roadmaps.

TRIMIS is an open-access information system to map and analyse technology trends, research and innovation capacities, as well as monitor progress in the transport sector.

Contact:

European Commission • Joint Research Centre, Ispra, Italy
Email: EU-TRIMIS@ec.europa.eu

<https://trimis.ec.europa.eu/>