TRANSPORT ANALYSIS

Connected, cooperative, and automated vehicles, vessels, and systems – a knowledge base

Summary
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Summary

The transport sector and its services are amidst several major change processes. Not every aspect of where this is leading can be foreseen, but there is strong consensus regarding certain distinct trends. Digitalisation will bring greater connection, cooperation, and automation while creating favourable conditions for the introduction of sharing services.

In light of this, the government has tasked Transport Analysis with producing a knowledge base covering all modes of transport and shedding light on the challenges and opportunities afforded by connected, cooperative, and automated vehicles, vessels, and systems. The report will also address sharing and fossil fuel freedom.

The primary benefits that a connected, cooperative, and automated transport system may bring are improved traffic safety, greater accessibility, reduced environmental impact, and more efficient use of infrastructure, vehicles, and vessels. There is considerable evidence that transport costs could be lowered as well.

The change process will have the greatest impact on road transport, and not only because that is the largest subsector in economic terms. It is also here that the benefits will be most palpable in the form of improved traffic safety, accessibility, and efficiency. This is partly because traffic accidents, emissions, and congestion constitute the biggest problems in this sector, and partly because other transport modes have progressed further along this development path. One significant reason why other transport modes have progressed further is that road transport involves a more extensive infrastructure, more actors, and more vehicles, and because the accessibility of the road transport system is unlimited in several respects. Conversely, rail and air transport are already functioning as systems with advanced traffic management.

The challenges identified can be divided into two categories: those depending on the *effects* of connected, cooperative, and automated transport, and those tied to *implementing* these properties in a desirable way.

Regarding the first category, it is in the road transport sector that such challenges have been identified, pertaining mainly to negative effects stemming from increased traffic. These challenges could offset the positive effects on traffic safety, accessibility, and the environment, and also contribute to a more dispersed residence pattern and a degraded basis for public transport.

Ride sharing will become very important if we are to succeed in limiting the anticipated increase in urban traffic without having to introduce direct traffic restrictions. This is essential to creating a good environment in built-up areas, and to managing the traffic safety, traffic flow, and environmental problems that increased traffic could entail. However, there is inertia with respect to simultaneous vehicle sharing, partly attributable to taxation legislation and labour laws. The growth in such sharing that has occurred in Sweden and internationally pertains mainly to the sequential sharing of electric scooters.

The challenges involved in implementing a connected, cooperative, and automated transport system are many and major. They span multiple sectors and levels, such as technology, law, and economics. Common to all, regardless of the transport mode in question, is that they often require solutions at the international level.

Our task also includes reporting on fossil fuel freedom. In view of other work in progress, Transport Analysis has limited this reporting to the effects resulting from connection, cooperation, and automation. Road transport accounts for 93% of the greenhouse gas emissions from domestic transport. Developments in terms of connection, automation, and cooperation could result in decreased emissions from road transport, partly due to the consequences of more fuel-efficient driving, the ability to form vehicle platoons, and smoother traffic flows. However, other factors could lead to increased emissions from road transport, such as new groups accessing cars, lower general travel costs, and the increased competitiveness of road transport. When and, if so, to what extent other directions of development, such as electrification, have an impact will greatly influence these effects and will in turn be greatly influenced by the policy instruments used to promote or counteract developments in certain directions.

The effects on our transport policy objectives are not clear cut. There are dimensions in which the trend is leading towards these objectives, as well as others leading in the opposite direction. Transport Analysis has used three scenarios in analysing this issue. Based on the developments in each of them, we have assessed how the key indicators used in Transport Analysis's annual follow-up of the transport policy objectives are affected. Regarding the overall transport policy objective, we see that connection affords opportunities to generate data about vehicle and vessel use that can be linked, better than at present, to their marginal costs, thereby enabling more precise fees, which in turn means that over- and under-internalisation can be more easily avoided.

The effects on the accessibility objective are essentially positive, mainly due to increased accessibility and more efficient traffic management. In the case of the impact objective, the specific effect per vehicle kilometre is expected to decrease, while there is the risk of a negative overall effect resulting from increased road traffic.

These developments contain a range of potential conflicts in terms of the transport policy objectives:

1) a cost-effective and integrated transport system versus society's vulnerability to extreme risks,
2) simple and efficient data communication versus data security, and
3) large-scale access to data for coordinating activities versus integrity risks.

These conflicting objectives will not resolve themselves. Transport Analysis recommends that the national responsibilities for risk management be clarified and that resources be allocated. Transport agencies and a number of industry actors have important tasks in this area.

Changes in policy instruments will be needed with regard to every mode of transport in a future of more connected, cooperative, and automated vehicles, vessels, and systems. All indications are that road transport will require the most radical changes. We believe that the regulatory systems of the future will be more like the current ones for maritime traffic, aviation, and rail transport. Some of the significant factors in terms of effects and policy-instrument needs concern the direction that spontaneous developments take regarding:

- individual versus shared access to self-driving vehicles
- individual versus shared use of self-driving vehicles
- implementation of self-driving vehicles in urban environments and rural areas
- adaptation and integration with today's subsidised public transport

Taking into account the uncertainties regarding future developments, it is clear that a broad range of policy instruments will need to be analysed for the future, such as whether, or perhaps rather where and when, there will be reasons to require connection and information sharing, what opportunities municipalities are to be given for more detailed traffic management, and whether incentives for greater sharing need to be created. Other important issues include whether the regulation of any monopolies for sharing services is necessary and how the interface between automated private transport and public transport is to be regulated.

The models used in traffic simulations and socioeconomic calculations in part to predict and analyse the effects of various transport policy measures will initially need to be adapted to the new conditions created by connected, cooperative, and automated transport. This pertains both to demand for highly developed input data regarding the value of time, travel, and transport costs, and to network capacity. In the longer term, Transport Analysis believes that new model concepts will be needed, but also sees that, with connected vehicles, real-time traffic information will be available, making it easier to predict driving behaviour when control and regulation, rather than individual decisions, determine how vehicles behave.

TRANSPORT ANALYSIS

Transport Analysis is a Swedish agency for transport policy analysis. We analyse and evaluate proposed and implemented measures within the sphere of transport policy. We are also responsible for official statistics in the transport and communication sectors. Transport Analysis was established in April 2010 with its head office in Stockholm and a branch office in Östersund.

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