Mapping of innovative and smart mobility solutions

In the North Sea Region

15 March 2021

CPMR NORTH SEA COMMISSION

Innovative and smart mobility solutions

Executive summary/ Key findings

This mapping report gives an overview of innovation activities in the transport systems in the North Sea Region. The information is provided by members of the transport group of the North Sea Commission. The report shows extensive activity on smart and innovative mobility solutions in the industry, academia and public sector.

The report groups the findings in four categories of innovative and smart mobility solutions:

a) Autonomous/automated transport in all modalities (on road (trucks, cars, public transport, etc.), rail, water/ maritime/ harbor/ inland waterways, air). The vehicles can be partly or fully automated.

b) Connected modes of transport (Cooperative Intelligent Transport Systems C-ITS, which means digital connectivity allowing vehicles and infrastructure to cooperate) and Intelligent transport systems – Road use charge as opposed to road tolls (f ex. geo-fencing) etc., digital parking ecosystems etc.

c) Innovative mobility concepts: Mobility as a Service, shared vehicles, shared micro-mobility (e-scoters, e-bikes…) etc.

d) New transport modes and test facilities (hyperloop/ pipeline, cable, drones etc.)

The aim of the mapping exercise is to share experiences between regions, explore the possibilities for closer cooperation and to identify partners for EU projects, as well as to give input to policy developments in the field of innovation and smart mobility.

The mapping shows that the North Sea Region has a high uptake of innovative and smart mobility solutions in the transport system and has world-leading companies and research institutes.

<u>More about the CPMR North Sea Commission</u>

The North Sea Commission is one of the six geographical commissions of the Conference of Peripheral Maritime Regions (CPMR). Our mission is to strengthen partnerships between regional authorities which face the challenges and opportunities presented by the North Sea. The North Sea Commission is a politically-governed cooperation platform for 27 regions around the North Sea in Belgium, Denmark, Germany, the Netherlands, Norway, Sweden and the United Kingdom. Through dialogue and formal partnerships we seek to promote common interests, especially in relation to European Union institutions, national governments and other organisations dealing with issues that are relevant to the North Sea.

Front page illustration: Trondheim city bike, National Road Authority, Norway.

1. Content

2. Introduction

2.1. Background

There are megatrends like digitalisation, automation and clean fuels/ electrification, in addition to societal changes such as an increasing awareness of climate change and the sharing economy, that are expected to radically change the transport systems in the future. The global pandemic which hit the world in 2020 is yet another factor that will challenge the travel patterns and the way we travel.

The regions are faced with the impacts of such trends, and they constitute both opportunities and challenges. There are for instance wide beliefs that new technology such as autonomous transport, will contribute to greater road safety, efficiency, mobility and accessibility for new groups in society, cheaper mobility and cuts in the emission of CO2 from transport. But there are at the same time challenges related to autonomous transport, if not regulated, it could lead to an increase in transport movements made by car, which is a problem in urban areas suffering from congestion and capacity problems in the roads. This is just an illustration of dilemmas that authorities need to consider, and act upon in the future. The regions are playing an important role in the development and uptake of innovative mobility solutions in their various roles such as planning authorities, road owners, organisers of public transport etc.

The mapping of the uptake of innovative mobility solutions in the North Sea region aims to help regions be pro-active and make use of the opportunities arising from such solutions. Such a mapping could also enable regions to mitigate risks and avoid pitfalls, such as investing in yesterday's transport technologies, or to a successful introduction of new transport technologies, e.g. when it comes to autonomous vehicles. The initiative also proposes that regions could and should play a role in policy development around innovative mobility solutions, in order to ensure that the innovation and new technologies are in line with the societal goals of economic, social and environmental sustainability, not at least ensuring a transition to a zero-emission, safe and efficient transport sector.

The EU has an ambitious agenda for harvesting the benefits of innovative mobility technologies in the EU, both in terms of creating new jobs and economic growth, but also reaching political goals of sustainability. On 9 December 2020 the EU released the Sustainable and Smart Mobility Strategy. The European Green Deal outlines the intended outcomes of this plan: to achieve a 90% cut in emissions by 2050 by delivering a "smart, competitive, safe, accessible and affordable transport system". This strategy forms the basis for how the EU transport system can successfully implement this green and digital transformation while increasing resilience to future crises.

The European Commission is an important driver for new policies, regulation and industry standards with regard to innovation and new technologies in the transport sector. For the purposes of the study it is relevant to monitor and analyse the policy and regulatory developments at EU, and national levels. It is also relevant to connect and exchange experiences with the Art-Forum (Interreg-project focusing on autonomous transport), https://northsearegion.eu/art-forum/

2.2. Purpose and objective of the initiative

The purpose of this report is to:

- map smart and innovative mobility solutions
- benchmark/ learn from each other

- explore the possibilities for cooperation and identification of partners for EU-projects in the field of innovative mobility solutions
- influence policy and regulations at the EU, national and regional levels
- showcase the North Sea region as a frontrunner in terms of developing or applying innovative mobility solutions

The overall objective is to:

- contribute to the development and uptake of innovative mobility solutions that contribute to transport and spatial development in line with the political goals in the regions on sustainability, efficiency and transport safety.
- achieve appropriate policies and regulations in line with the position of the North Sea Commission (NSC) and its members in this field, and an EU «level playing field» in the market for innovative mobility solutions.
- position the regions as attractive partners for activities and investments in the field of innovative mobility solutions.

2.3. What do we mean by «innovative and smart mobility solutions»?

The terminology and definitions of the EU will be applied for the purposes of this study.

Some of the technologies, solutions and concepts that will be relevant for the purposes of the study are:

a) Autonomous/automated transport in all modalities (on road (trucks, cars, public transport, etc.), rail, water/ maritime/ harbor/ inland waterways, air). The vehicles can be partly or fully automated.
b) Connected modes of transport (Cooperative Intelligent Transport Systems C-ITS, which means digital connectivity allowing vehicles and infrastructure to cooperate) and Intelligent transport systems – Road use charge as opposed to road tolls (f ex. geo-fencing) etc., digital parking ecosystems etc.
c) Innovative mobility concepts: Mobility as a Service, shared vehicles, shared micro-mobility (e-scoters, e-bikes…) etc.
d) New transport modes and test facilities (hyperloop/ pipeline, cable, drones etc.)

The mobility solutions do not have to be technology intensive (e.g. like autonomous transport), but can represent new, or smart ways of solving transport needs in a more efficient or sustainable manner. The innovation can originate from new ways of organising mobility services or represent a new business model.

2.4. Scope and demarcation

By mobility we mean the transport of persons, freight and goods.

The mapping is not meant to be limited to the plans and activities which the regional authorities are involved in or responsible for, but should also include relevant activities on the part of other actors in the regions, such as state agencies, municipalities, technology developers and business organisations etc.

The report is proposed to be held at a strategic, high-level.

3. Plans and strategies

This chapter presents the plans, strategies and/ or measures for testing or rolling out innovative mobility solutions in the transport system in the regions of the North Sea Region.

Aberdeen and Aberdeenshire: The Regional Transport Strategy (RTS) for the North East of Scotland is currently being updated for the period 2020-2040: www.nestrans2040.org.uk.

The consultative draft RTS recognises that trials of Connected and Autonomous Vehicle (CAV) technology are already taking place in Scotland and internationally and identifies as a priority the need for the north east of Scotland to position itself to be able to take advantage and enable pilots and trials in the region. The draft document also identifies aspirations for much improved mass transit solutions, potentially as part of wider package of measures based around Mobility as a Service (MaaS) principles and technology.

Aberdeen
Aberdeen City Council's Local Transport Strategy (2016-21) identified the uptake of ultra-low and low emission vehicles as a key city priority:
https://www.aberdeencity.gov.uk/services/roads-transport-and-parking/local-transport-strategy .
Work will shortly be beginning on the next Local Transport Strategy which will be informed by the updated Regional Transport Strategy.

Aberdeenshire
Local transport Strategy will now be developed to incorperate the updates to the Regional Transport Strategy mentioned above.
Aberdeenshire have also created a specialist position to deal also with development of the issues covered by this NSC report within their own projects and strategies and to engage in specific project development. As such we welcome any and every interaction on this subject by email to transportinnovation@aberdeenshire.gov.uk

Region Västra Götaland's main document for realising growth and development in the region is the Joint Strategy Västra Götaland 2020 (VG2020). Through this strategy, the aim is to further strengthen the profile of the region as an attractive, responsible and internationally competitive knowledge region.

Møre og Romsdal County: The consultative draft of the strategy for the transport sector in Møre og Romsdal county 2021-2024, gives direction for the implementation of mobility in the region. The strategy is based upon UN sustainability goals. One of the goals in the strategy is that Møre og Romsdal want to have competitive, attractive and cost-efficient mobility services.

Strategies include testing of innovative mobility solutions, to facilitate coherent mobility services, infrastructure measures, and digital solutions.

For Møre og Romsdal, it is important that the services must be fit for medium-sized and smaller cities, in addition to rural areas.

https://mrfylke.no/om-oss/planar-planarbeid-og-hoeyringar/hoeyringar/fylkesstrategi-for-samferdsel-2021-2024

There are several plans, both locally oriented in our municipalities, and regionally oriented projects which include the region as a whole. The most specific plans are:

- Developing and launching a smart mobility hub including all multi-modal mobility services
- Developing and launching a new business model and technological platform for Demand responsive transport (DRT)
- A variety of mobility projects related to different SMART City activities across the county.

Maritime sector:

The county council have several ongoing initiatives within maritime public transportation:

- The feasibility study "Smarter transportation" is conducting research of a system for public transportation solutions by sea in urban areas, investigating the possibilities for introducing autonomous passenger ferries in the regional cities close to or surrounded by water. 20,5 MNOK is allocated to carry out the project within the project period (2019-2023). The Ministry of Transport is funding the project with 12,5 MNOK and the county council has granted 8 MNOK to support the study.
- Mapping possibilities for introducing zero emission fast ferries for the future in our next tender is also in progress. 2 MNOK support from Klimasats, funded by the Norwegian Environment Agency, will be financing this work through 2020-21.

Rogaland county council: Rogaland County council has adopted a new mobility strategy for the period of 2021-2027. For more information on the strategy: https://www.rogfk.no/_f/p1/if87babb5-30e8-4f58-9a4f-8bc3b209aa53/strategi-for-mobilitetspavirkende-tiltak-i-rogland-2021-2027.pdf

Since 2007, the 11 municipalities and the **North Denmark Region** have worked together on priorities within mobility and infrastructure to benefit the regional development. This cooperation has produced a Masterplan for the North Denmark Region towards a joint sustainable mobility. The plan contains concrete goals, strategies and actions to be taken before 2040. It furthermore provides a plan of the actions already in place, and the ones to be taken the next couple of years.

There are 3 main goals in the Masterplan:

1. Improve the accessibility and strengthen the interconnection to the rest of Denmark and Europe.
2. Strengthen the local mobility and the interexchange between country and city.
3. Improve traffic safety and health and reduce emissions locally and in the climate.

And 7 strategic actions:

1. Ensure a sustainable, effective and reliable mobility network for goods and people.
2. Promote green mobility solutions
3. Promote active and shared forms of transport.
4. Support local mobility planning.
5. Ensure good digital infrastructure and intelligent transport systems.
6. Strengthen the main transport connections for passengers and goods.

All the above is supported by concrete actions to be taken in close corporation with the business community in the North Denmark Region.

Vestland County has strategies and plans for mobility in a number of areas. The goal is sustainable towns and rural districts. We use all measures that contribute to the best possible mobility and flexibility for the inhabitants, which at the same time leads to reduced need for private cars. Vestland County strives for more SMART mobility. To achieve this, we believe in collaboration with a wide range of partners and smart use of technology.

To ensure good collaboration between start-ups, industry stakeholders, municipalities and the county, Vestland County – together with the City of Bergen and the Norwegian Public Roads Administration – established the mobility laboratory MUST (Mobility lab for Development of Smart Transport) in 2018. MUST is partly funded by the Norwegian Ministry of Transport and is a result of a national competition arranged by the ministry.

Vestland County has plans and measures for electrification, autonomous vehicles, mobility concepts such as Mobility as a Service, shared vehicles, shared micro-mobility and intelligent transport systems. Concerning new transport modes (hyperloop / pipeline, cable cars, drones etc.) there are no known plans in Vestland County.

When it comes to fossil-free transport, Vestland County is well underway. The goal is to become fossil-free by 2025. This goal encompasses mainly the county's own goals. For Bergen City there is a goal to be fossil free by 2030. Means to achieve this in all modes of transport are ongoing. There are no ongoing test projects for autonomous vehicles, but this was tested in 2019 in cooperation with the City of Bergen. A feasibility study in cooperation with Sunnfjord Municipality is under preparation.

Within ITS and Connectivity, Automatic signal prioritization (ASP) has been tested for public transport in Bergen. ASP has produced good results with improved accessibility for the public transport, but permanent implementation has not yet been decided. Vestland County is also working with all our partners to digitalise buses, boats and light rail. We collect data from all vehicles to publish them, to make it possible for passengers to identify the number of available seats, real time arrival and more.

When it comes to "Mobility as a Service", the public transport agency Skyss is working to digitalise the ticketing systems to make them accustomed for other modalities such as trains, bicycles and scooters. The shared bike service Bergen City Bike is already a part of the Skyss travel planning app, “Skyss Reise”. The City of Bergen and Vestland County is collaborating to develop one common ticket app for PT and city bikes.

- Linkedin: https://www.linkedin.com/company/must-bergen/

Nettside: https://www.bergen.kommune.no/MUST

Groningen (and also Drenthe) is working on a new regional mobility plan which will contain a substantial part dedicated to smart and green mobility. The mobility program of Groningen is placing walking and cycling as well as preventing unnecessary mobility and a policy of 'no new infrastructure unless' on top of the priority list. These priorities are closely followed by an innovative mobility policy, which also supports and catalyzes these priorities and which helps to reach the goal of overall zero emission mobility as a whole ultimately in 2035. The new mobility program will be ready in 2021 and has a duration of at least 10 years.

The main components of the innovative mobility policy are:

- A program for autonomous transport in all four modalities, which will be scaled up in the next coming years and has a main focus on the rural areas. From 2022 this program will even have a fifth modality with the opening of the first European Hyperloop Center in Groningen.
- A program for smart logistics with a main focus on the so called physical internet.
- A program for open and connected networks with a main focus on Hubs and shared mobility solutions (bicycles, scooters, cars, etc.).
- A program for zero emission mobility with a main focus on hydrogen solutions (see also the earlier report concerning the mapping of alternative fuels).
- A program for smart and connected networks with a main focus on solutions like MaaS, Intelligent Traffic Lights, 5G and the behavior of all mobility users.

The regional governments in Groningen work closely together on realising the goals of this policy with knowledge institutions and private parties in the innovation center called hive.mobility. Hive.mobility is the network organization for all smart and green mobility solutions in the region (see www.hivemobility.nl).

On a national scale we have joint forces with other region and the Ministry to exchange knowledge and taking Smart Mobility to the next level. This cooperation is called 'Krachtenbundeling Smart Mobility' and contains several theme groups like for instance Digitalization, MaaS/Hubs/Shared Mobility, Autonomous Transport and a Human Capital Agenda.

Vestfold and Telemark county

The Vestfold and Telemark county adopted a Regional Plan Strategy for the period 2020-2024 in December 2020. The plan establishes strategies for achieving green transition in the region, and moving the society in the direction of the sustainable development goals of the UN 2030 Agenda. The strategy aims to build an inclusive society, with economic growth through a green transition, and to reduce carbon footprint and damage to the ecological systems. This is the first plan strategy for the new region, which is merger between the counties of Vestfold and Telemark. The region is a substantial transport authority and mobility operator – being the largest road owner in the region, responsible for the public transport services, and part owner of the regional airport (Sandefjord Lufthavn Torp), and a regional development actor. The region is planning to apply innovation as part of the “public procurements” in order to obtain smart mobility solutions. The region will have a focus on managing and developing the road network in a cost-efficient manner, making use of intelligent solutions for smart maintenance of the roads, and are developing a Life Cycle Analyses approach for the investments in the road infrastructure with the aim of reducing the carbon foot print and other environmental costs. The region will develop its public transport services, and make pro-active use of innovative mobility solutions in order to strengthen the attractiveness of sustainable transport modes. The region has successfully tested using ITS in the traffic lights in order to prioritise buses in the traffic in the cities, which gives the bus an “advantage” over the private cars.

The plan establishes that the region will work in partnership with other actors in society, such as the municipalities, state and transport authorities, academia and industry, in order to achieve it’s goals of a sustainable development. There are a number of on-going state infrastructure projects in the region- both motorway and railways. The region is working to promote the establishment of double-track railways as part of the InterCity-project in particular, and to improve the train services through-out the region.

The urban area of Grenland (Porsgrunn and Skien) has a comprehensive urban environment and transportation agreement which involves the state, county and the municipalities with the aim of promoting environmental friendly transport based on zero-growth in the transport by individual vehicles. This is an instrument to achieve binding cooperation and funding. There is currently a redraft of the strategies on transportation and city development, including a project on "new technology and smart mobility" which is exploring the possibilities for using innovative solutions in the transport system. The project has used new guidelines developed by the Norwegian Road authority (a methodology) for the use of smart mobility in the transport planning. Some examples of the initiatives include work on Intelligent transport systems (ITS), combined mobility/ Mobility as a Service, data/ architecture, knowledge of travel behavior through passenger counts in busses or use of mobile data. The county is working with the municipalities and the state to achieve a similar binding agreement for comprehensive plan for areal use and transport in the Tønsberg-region.

Vestfold and Telemark has a goal to establish the region as a national hub for environmentally friendly freight logistics transportation (Regional intermodal transport plan, 2015). The main strategy is to promote the modal shift from land to rail and sea, and to promote the multimodal "Jutland corridor" between South Norway and North Denmark. There is cooperation between the region, railway authorities and harbours to remove "missing links" and make the necessary adjustments on the railways in the region for goods transport ("Gods concept Vestfold and Telemark").

The county is developing a pilot for freight logistics in the cities of Vestfold.

Region South Denmark's most recent regional development strategy 2020-2023 - Southern Denmark of the Future - focuses on providing regional development with the SDGs as a holistic framework with tightly interlinked goals. Politically approved in May 2020, the development strategy includes six strategy tracks. Each of the strategic tracks will be implemented through specific sub-strategies, including a mobility sub-strategy called - Mobility for All.

The sub- strategy - Mobility for All – includes three regional goals:

- Green and climate-neutral transport – public and private.
- High accessibility and good infrastructure links – transport and digital
- Reduced congestion in and between towns and cities in Southern Denmark

In order to improve accessibility and reduce congestion, the sub-strategy specifically includes three infrastructure priorities, jointly decided by the Region of Southern Denmark and the 22 local authorities in 2011, and updated most recently in 2019:

- Implementation of the One Hour Plan for long-distance high-speed trains, with five anticipated stops in Southern Denmark (Odense, Esbjerg, Fredericia, Kolding and Vejle), including a southbound connection in Jutland that can contribute to an improved connection to Hamburg.
- A Mid-Jutland Motorway linking up with Billund Airport, and with a cross-connection to the E45 motorway south of Vejle.
- A Parallel motorway connection across the Little Belt.

In addition to these three priorities, the region also highlights widening the E20 motorway south of Odense and double tracking the main railway between Tinglev and Padborg as projects it is seeking to have financed and completed by central government.

The Region Örebro County has a regional development strategy as the main document for working to achieve three main goals; strong competitiveness, high and equal quality of life, good resource efficiency.

The overall goals describe what the organisation wants to achieve in our county and are a guide for collaboration within the priority areas of the strategy. The goals describe how the regional development strategy contributes within the three dimensions of sustainable development. By constantly striving for strong competitiveness, high and equal quality of life and good resource efficiency, we steer towards one sustainable development - economically, socially and ecologically.

To achieve the organisation's overall goals, the county's actors have agreed to collaborate within ten priorities areas. In everything we do, gender equality, children and young people, international cooperation and integration must be important starting points.

Link to the strategy:
https://www.regionorebrolan.se/4aeceb/globalassets/media/dokument/regional-utveckling/rus/regional-utvecklingsstrategi-kortversion.pdf

Smart specialisation
Smart specialisation is the regional policy framework for innovation-based growth. Simply put, Smart specialization functions as a method, a tool and a way of working to prioritize initiatives and development projects that strengthen companies, public structures, research and civil society and, by extension, Örebro County's attractiveness and competitiveness.

Region Örebro County's innovation strategy:
https://utveckling.regionorebrolan.se/4aef62/globalassets/media/dokument/policy-program-handlingsplan/regional-utveckling---policy-program.-handlingsplaner/innovationsstrategi-orebroregionen.pdf

Artificial Intelligence (AI) Impact Lab
AI Impact Lab strengthens the region's development in artificial intelligence by acting as a meeting place where companies and the public sector have access to the latest knowledge in AI. AI Impact Lab hosts the Örebro Node within AI Sweden, Sweden's national center for artificial intelligence.

AI Impact Lab - a collaboration between Örebro University and Örebro County Region - is the industry's and the public sector's entrance to AI competence at Örebro University. AI Impact Lab wants to bring together academia, companies and public activities in an innovation system and together accelerate AI development in the region. This will take place within the framework of **ORU Innovation Arena.**

Learn more: https://www.oru.se/samverkan/innovation-och-ideutveckling/ai-impact-lab/

Preparatory project - AI in Transport and Logistics
Region Örebro County is together with the network CLOSER (transport efficiency network) and leading Swedish players in AI involved in a preliminary project with the aim of raising awareness and knowledge about possibilities of using different types of data.

The goal is to carry out a feasibility study in a first step to identify regional and local logistics flows where AI technology can be an enabler for increased transport and logistics efficiency. Expected deliveries are needs analysis with associated key players, potential benefits and identifying use cases that in the next step can be taken further in a demonstration project.

In the spring of 2021, 2-3 workshops are planned in collaboration with AI Innovation of Sweden in regional nodes and supplementary interviews. The work also includes developing proposals for follow-up projects in order to be able to test and demonstrate new solutions in the next step. One of these workshops will be carried out in the Örebro region and target companies active in the transport and logistics industry.

4. Implemented tests and projects

This chapter focuses on experiences with implementing or testing innovative mobility solutions in the North Sea Region. The initiatives are either conducted by the member regions or external actors. The chapter presents the experiences of the project owners, users, society (evaluations, impact assessments etc.).

4.1. Autonomous/automated transport (all modalities)

Gothenburg is the location of Sweden's largest freight port and energy-efficient freight transport is high on the agenda. Volvo runs a project in the port with autonomous freight transport called **Vera**. Vera has the potential to optimise transports in highly repetitive short-distance transport flows with large volumes of goods, such as ports, factory areas and logistic mega centres.

This is autonomous freight transport (Vera)

Møre og Romsdal County:

In Kristiansund, a project initiated by the historical urban passenger boat “Sundbåten”, will be a pilot for autonomous public transportation within the harbour basin. The project is linked to the research performed in “Smarter transportation”, but is focusing on the actual testing and introduction of the sensor technology on board and on shore – finally leading to construction and building of a new

vessel for the Sundbåten route. Sensor surveillance and learning is already put out to test, and the actual vessel construction will be starting up in 2021 according to the project timeline.

Rogaland County:

Rogaland county council is, and has been, involved in piloting of autonomous bus services. The first autonomous passenger-carrying bus in Norway operated from the summer of 2018 until the end of year 2018. More than 6000 passengers tried the bus.

The municipality of Gjesdal in Rogaland is currently cooperating with Rogaland county in an EU-financed project, FABULOS, in testing autonomous buses in the summer and fall of 2020: https://fabulos.eu/gjesdal-pilot/ and https://fabulos.eu/gjesdal-pilot-2/.

Kolumbus has also introduced a pilot project with an autonomous bus service in the city center of Stavanger Q4 2020 and this is intended to operate for 2 years.

North Denmark Region

Autonomous/automated transport on roads

SMARTBUS AALBORG

The Municipality of Aalborg has together with the Danish mobility- and autonomous tech company, Holo, launched the first autonomous buses in Denmark in the eastern part of Aalborg. The three buses were put into operation the 5th of March 2020.

The purpose of the project with the autonomous technology, is partly to transform a marginalised residential area into a social sustainable and interconnected urban space, and partly to bring better and safer mobility to the citizens in the area. Therefore, the project is not meant as a showcase project, but an attempt to develop social inclusion, safety, mobility and an improved image of an otherwise marginalised part of Aalborg.

The bus route has 10 stops, and is programmed to only stop at the dedicated stops every 15 min. The route is 2.1 km. The bus navigates by means of build in sensors and software, which makes it capable of registering the surroundings within 60 meters. If the bus registers unidentified objects, people or other obstacles on the route, it will either slow down or stop completely.
An operator from Holo will be available in the bus in the beginning in order to give passengers a safe and pleasant experience. The buses will be running for a two-year period, with the hope to continue in regular operation afterwards.

Read more about the SmartBus here: https://smartbus.dk/

Fjordbus Aalborg

Center for Logistics and Cooperation has together with local companies and organisations initiated an autonomous ferry service with the purpose of connecting Aalborg and Nørresundby which are two cities in North Denmark divided by a fjord. The autonomous ferry is meant as a comfortable and sustainable alternative for people on bike, with a stroller or just walking. It will connect the residential

area Stigsborg Brygge with Musikkens Hus (House of Music). The autonomous ferry is a sustainability project that will be inaugurated in 2022 when all 7 phases of ensuring the security have been completed.

Read more about the FjordBus here: https://logsam.dk/fjordbus/

Central Norway:
AEGIS: Autonomous ships meet automated ports

EU's Horizon 2020 project AEGIS develops connected and automated waterborne transport

Inland and short sea ships and their ports is a critical part of Europe's transport system. With stricter requirements on decarbonisation and reduced noise and pollution from the transport sector, the importance should only increase! However, the convenience and flexibility of road transport still tend to trumph the sustainability goals. The AEGIS project has been selected by the EU Commission to show that autonomous ships and automation in ports can make waterborne transport much more flexible and user oriented, while continuing to reduce the societal and environmental impact of EU transport. This will be the "Advanced, Efficient and Green Intermodal Systems" - AEGIS.

Small ships and inland barges can decongest roads, reduce noise and dust pollution, while operating on batteries or other non-carbon fuels. By automating ports and terminals and use these to integrate larger long distance ship operations with new and smaller ship types, a completely new European transport system can be developed. More flexible and user centric transport, better services to rural as well as urban areas and a revitalization of the regional ports and city terminals is the goal.

The AEGIS use cases are located in North Europe and represent typical short sea transports that need to be linked to local distribution systems. Case A is led by North Sea Container Lines in cooperation with the the Port of Trondheim. It uses small cargo shuttles to link coastal container ships to rural and urban destinations. Case B is led by DFDS and will link RORO short sea services to inland waterways. Case C in led by Port of Aalborg in cooperation with Port of Vordingborg and will examine how existing ports can use automation to facilitate the transfer of cargo from trucks to sea.

A. **Short sea terminals:** Transport from large ports in Europe (e.g. Rotterdam) to smaller destinations along less populated coasts of Europe. This is a LOLO, and mainly container-based transport system. The idea is to use fewer terminals closer to the main fairway to increase main service speed and then shuttle cargo to final destination with small unmanned and preferably autonomous and electric vessels to increase flexibility.
B. **Short sea and inland shipping interface in Belgium and Netherlands:** Interface between RORO transport from several North European ports to Rotterdam, Ghent and Zeebrugge and

further on with waterway connections to smaller inland destinations in Flanders. The idea is to bring cargo as close to the end destination as possible (final delivery) with smaller zero emission vessels utilizing the benefits of more automation in the concepts being developed.

C. **Revitalizing regional ports and city centre terminals:** Due to real estate development at the waterfront, the Danish SME ports in Aalborg and Vordingborg have moved out of the city centres, but is still well located. To be competitive with road transport they need to increase efficiency at its terminals to reduce costs and secure higher frequency by feeders, be competitive at the RORO segment and provide multimodal green logistics solutions combining short-sea shipping with rail transport.

In addition to the use case owners, the consortium consists of technology providers Cargotec and MacGregor (cranes and cargo equipment), Grieg Connect (Digital integration) as well as ISE, DTU, AAU and SINTEF Ocean as research partners. The AEGIS consortium comprises 12 highly qualified partners from 4 countries: Norway, Denmark, Finland and Germany. The project is coordinated by SINTEF Ocean in Norway

AEGIS will give a series of positive impacts related to the overall policies of EU concerning a shift in freight transport from road to waterborne and rail:

- Decongest road and/or city infrastructure;
- reduce the CO2 and air pollutant emissions of intra-European freight transport;
- enhance the performance of the CEF TEN-T network;
- substantially increase the amount of freight fed from intercontinental European ports using waterborne transport;
- modernise, increase the reliability and competitiveness of Intra-European Waterborne transport;
- increase the quantity of freight moved by Inland Waterways or Short Sea Shipping;
- reduction of accidents and injuries in the waterborne sector;
- strengthening the European maritime industry.

AEGIS is a three year long research and innovation project with a total funding of 7,5 M€ from the European Union's Horizon 2020 research and innovation program under Grant Agreement N°859992. It will leverage a multidisciplinary team to integrate new innovations from the area of Connected and Automated Transport (CAT) to design the next generation sustainable and highly competitive waterborne transport system in Europe. This includes more diverse sizes of ships and more flexible ship systems, automated cargo handling, ports and short sea shuttles, standardized cargo units and new digital technologies.

Groningen (Northern Netherlands) has been running an autonomous transport program together with Drenthe and Fryslân called @north (www.at-north.nl) since 2016. This started only on the road and has now evolved into all four modalities with tests with shuttles, trains, ships and drones. Making it the only region within Europe that is testing all four modalities. Good examples of these pilots are the shuttle project in Scheemda, the pilot for medical deliveries with drones and the ATO (Autonomous Train Operation) tests with passengers between Groningen and Zuidhorn and Groningen and the border with Fryslân. For all four modalities Groningen is now aiming on making the step from the pilot phase towards a scale up in bigger and broader projects. Furthermore we are also involved in two Interreg project about: the ART-Forum project and Kontaklos Laden (lead

partner). And we are currently preparing a Horizon Europe call with several partners about certification and the software license.

The @north logo and websitelink, the Scheemda project and an overview of all four modalities.

And now Groningen is working out a plan the build real field labs of governments, knowledge institutions and private partners around these five modalities of autonomous transport and connect them so they can exchange relevant knowledge. In these field labs a lot of research and development work is done including ongoing tests in theory and practice. One of the main focus points of these field labs will be to become an European Hub for the certification of autonomous transport.

Vestfold and Telemark county

Norway has world-leading actors in maritime autonomy, i. e. technology that allows a vessel to sail by itself, independent of human interaction, and Vestfold and Telemark county is home for several development projects that are being tested.

The world's first adaptive ferry transit with passengers conducted during normal service was carried through in February 2020 on the ferry connection in the Oslofjord between Horten (Vestfold and Telemark) and Moss (Viken). The ferry connection is operated by the Norwegian state and is the busiest in Norway, with an annual number of 3.8 million passengers and 1.8 million vehicles transported on this route. The landmark trial was carried through as a fully automatic from dock to dock control and the ship was fully loaded with passengers and vehicles. The technology was provided by Kongsberg. The Bastø electric ferry is the world's largest electric ferry (March 2021).

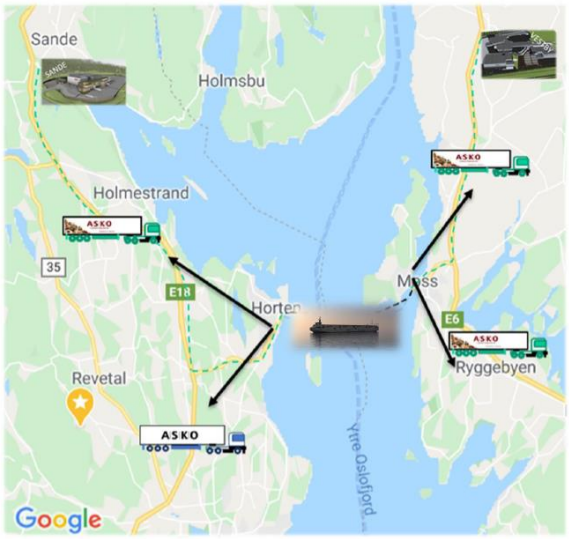
Illustration: Bastø electric – the world largest electric ferry, and highly automated ferry service

What can become the world's first fully electric and autonomous containership, the "Yara Birkeland" has been delivered to Yara, the Norwegian fertilizer and chemicals company, and is currently being equipped in the port of Horten, in Vestfold and Telemark region. The goal is to move transport from land to sea and cut climate gas emissions. The containership is expected to replace 40 000 annual truck journeys between the ports Herøya and Brevik. The ship will be tested and operate at lower levels of autonomy until the autonomous technology is mature enough for unmanned operations. For the autonomous logistics on land the project team continues to look for simplified solutions to this. Yara's goal is to complete the project and bring the emission-free ship into commercial operation. Different ownership models or partnerships will be evaluated for operation and commercialization.

Illustration : the containership "Yara Birkeland"

ASKO, Norway's largest grocery wholesaler is developing a zero emission logistics chain between the warehouses on both sides of the busy Oslofjord. The systems will involve autonomous sea vessels (sea drones), smart port solutions and electric trucks. The zero emission vessels, both battery driven, will have the capacity to carry 16 trailers of cargo, each with a maximum capacity of 29 tons. They will reduce road travel by two million kilometres and cut carbon emissions by 5000 tons annually. The plan is to begin using this new form of transport from the spring of 2022, initially with a reduced crew. During a testing period of about two years, the first of the two vessels will gradually build up its autonomous capability. Approval for fully unmanned operations is expected during 2024. The company is committed to sustainability and investing heavily in new technologies such as electric and hydrogen-powered vehicles. At present road transport is the single mode of transportation to

link their warehouses on the western side of the Oslo fjord with their distribution center on the eastern side. The new RORO (Roll on, roll off) vessels will replace the current solution with a zero emission transportation alternative. Their goal is to be 100% emission free transport by 2026. Fully electric trucks will take the cargo between the warehouses and the ports of Moss and Horten, and in shipments of 16 the trailers will be transported across the fjord on battery driven sea drones, The solution is cost effective, sustainable and will remove trucks from the heavily trafficked roads.



Autonomous, electric seadrones and logistics chain on land (the two sea drones will replace 150 daily trips by lorry between Østfold and Vestfold. The autonomous vessels are set to cross the Oslofjord as of 2022.

Illustration: Route of the zero-emission logistics chain in the Oslofjord

Illustration: Autonomous, electric seadrones are set to cross the Oslofjord as of 2024

There are several initiatives and projects at the University of Southeast Norway (USN). USN include an Institute for Maritime Operations (IMA). Their aim is to educate maritime officers and sea man as well as conducting R&D on maritime related areas. In 2022 they will launch a master program on autonomy. On the research side they are engaged in a number of larger R&D project like:

- Autostrip (Autonomous systems in transport)
- RAPP- Autonomous passenger ferries
- Water shuttle (Vannbuss) in Tønsberg, Sandefjord and Drammen
- Autonomous logistics like Yara Birkeland, ASKO
- Smart condition Monitoring- SCM
- Portbin Robot (Autonomous garbage collector for maritime applications)

USN is also operating a national maritime test center for autonomous vessels.

There was a planned pilot-project at Signo, Andebu, testing out an autonomous bus service at a campus for visually impaired was put on hold due to the Covid-19.

There are several initiatives in the industry and the university to apply for funds for Research and Development and piloting of innovative mobility solutions, and the region is offering support and to

be a partner in the development of projects and applications. The industry park Herøya in Porsgrunn is developing autonomous logistics systems at their site, and have plans to explore the possibilities for autonomous multimodal transport (application Orchestra Horizon Europe).

Weser and Ems Region, Germany

AVATAR (Sustainable urban freight transport with autonomous zero-emission vessels modal shift from road to water) brings together 7 partners from 3 countries (BE, DE and NL). The project focuses on the massive under-exploitation of inland waterways (IWW) in the North Sea Region, especially in and around urban environments, which provides opportunities for technological innovations. This project aims to deploy zero-emission automated vessels that can-do hourly traffic between the Urban Consolidation Centers outside the city and inner-city hubs, focusing on the distribution of palletized goods and waste return.

The AVATAR project will develop, test, and assess adequate technologies and business models for urban autonomous zero-emission (IWT). Through this, the project will unlock the economic potential of urban vessels and corresponding waterways, increase available solutions for full-cycle automation and set up a sustainable supply chain model for urban goods distribution and waste return.
The German Partner is the University of Oldenburg with the OFFIS-Institute for Informatics.

ART-FORUM (Automated Road Transport Forum) has 13 beneficiaries and one co-beneficiary from 6 countries (DE, BE, DK, NL and the UK).
The project's aim is to create a debating ground for local/regional authorities, address risks and opportunities and help guide policy development with regard to the impact that automated transport could have on the road transport system and life in cities and regions of the North Sea Region. Specific objectives include:
- Develop policy recommendations that enable local and regional authorities to take advantage of the opportunities of automated road transport
- Support sustainable transport and territorial development goals as well as improve quality of life in communities
- Facilitate exchange between technological developers and policy makers DLR Institute of Transport Research (Köln), City of Bremen (project leader) and Mobile Zeiten (Oldenburg) are the German partners in the project.

Lower Saxony

Test Bed Lower-Saxony for automated and connected comobility

Open research and development platform in the development of automated and connected vehicles, powerful and flexible test infrastructures are an important tool. For this purpose, the German Aerospace Center (DLR) is constructing the Test Bed Lower Saxony, which is funded by the Niedersächsischen Ministerium für Wirtschaft, Arbeit, Verkehr und Digitalisierung (Lower Saxony Ministry of Economics, Labour, Transport and Digitisation) and the Niedersächsisches Ministerium für Wissenschaft und Kultur (Lower Saxony Ministry of Science and Culture) with funds from the European Regional Development Fund (ERDF) and the State of Lower Saxony. Support is provided by the following partners: ADAC Niedersachsen/Sachsen-Anhalt e.V., Continental AG, IAV GmbH, NordSys GmbH, Oecon Products & Services GmbH, Siemens AG, Volkswagen AG and Wolfsburg AG. An open research and development platform is being created, enabling a unique and comprehensive combination of different test and trial possibilities to be offered - from simulation through to routes in public spaces. The development of the infrastructure for the project Test Bed Lower Saxony and

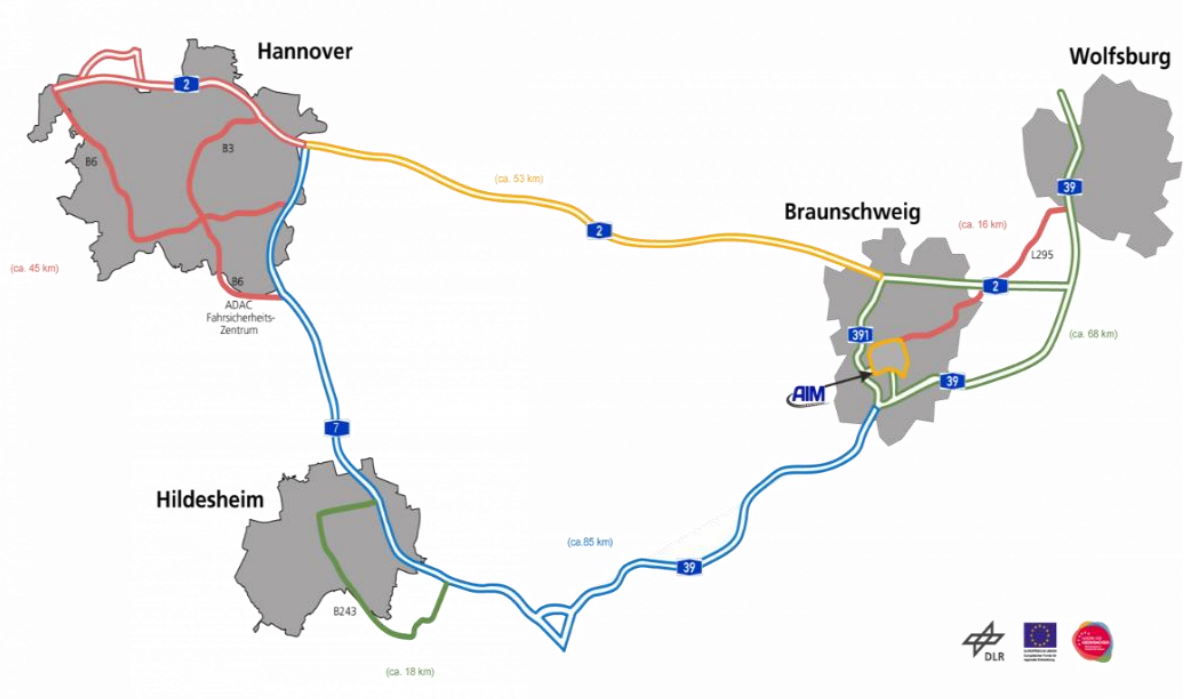
the digitalisation of the road network were realised with funds from, among others, the European Regional Development Fund and the States of Lower Saxony.

Urban-rural motorway

The Test Bed Lower Saxony encompasses sections of the A2, A7, A39 and A391 motorways as well as parts of the federal and state roads B3, B6, B243 and L295. Furthermore, it also integrates the established routes of the Application Platform for Intelligent Mobility (AIM), which is in operation in the Braunschweig city centre. This enables testing in differing traffic situations and in the transition between different types of road. Once completed, the Test Bed Lower Saxony will cover a total of more than 280 kilometres, with sectors containing the most diverse forms of technical equipment.

Integral tool chain

The tools of the Test Bed Lower Saxony offer various simulations which also enable, in particular, hardware-in-the-loop/software-in-the-loop, driver-in-the-loop and vehicle-in-the-loop investigations. Via the test site and traffic trials under real conditions, the tool chain extends into the public domain. The individual elements of the tool chain can be used in an integrated way, for example to optimally combine the respective advantages of synthetic and real environments in tests.



High-precision acquisition technology

The high-precision acquisition technology of the test bed detects all vehicle positions with high precision and thereby provides the exact traffic situation - in terms of ground truth - for analysis and live services. A live service emulates, for example, position signals which would be known and searched for if every vehicle were equipped with Car2X technology. Corresponding messages are generated by the test bed.

For whom is this interesting?

- Partners from industry and science who develop and/or produce sensors for automated vehicles

- Partners from industry and science who work on automated and connected driving functions.
- Partners from industry and science who develop novel technology modules in vehicles and the transport infrastructure
- Scientific institutions conducting research on the topic of automated and connected mobility
- Politics and associations who would like to obtain information on the topic of automated and connected driving

For more information: https://verkehrsforschung.dlr.de/en/projects/test-bed-lower-saxony-automated-and-connected-comobility

4.2. Connected modes of transport (ITS and C-ITS)

Aberdeenshire Council has trialed a remote sensoring real time weigh in motion installation into the surface of a local road as part of a policy to deter overweight vehicle use of one of its vulnerable structures.

North Denmark Region

Bike barometer: In Aalborg Municipality, bike barometers have been installed along the most popular biking lanes in Aalborg. The bike barometers give visibility about cyclists and is meant to inspire others to use the bike instead of the car. The barometers measure the bike traffic, ex. the numbers of bikes who have passed the current day, and they show the speed of the cyclist as passing by the barometer. They also estimate the time for selected destinations such as Aalborg University or the city center.

Vestland County has tested Automatic signal prioritisation (ASP) for public transport in Bergen, and works on digitalising all transport modes for real time information purposes.

Groningen (Northern Netherlands): An initiative that is worth mentioning over here, is the 5G lab of Groningen called 5Groningen (www.5groningen.nl). Several tests with 5G have been done already over there, including a number of mobility ones (drones, ambulances, etc.). And we also work together on a project that combines 5G and autonomous transport.

Furthermore the Northern Netherlands is involved in a national program in which every traffic light will eventually be replaced by a smart one (I-VRI). These intelligent traffic lights can communicate with vehicles and arrange the best way to handle busy traffic intersections themselves by giving every direction a green light just the right amount of time.

Vestfold and Telemark: The industrial park at Herøya in Porsgrunn has inaititives with the aim of automated logistics of freight and persons in the industrial park, and to and from the industrial area. They have applied to perform a project that will develop a traffic management system for freight and persons across transport modes to the Horizon 2020.

Illustration: Prime minister Erna Solberg and colleagues from the government opens a pilot on autonomus bus at Herøya, 30 october 2020

The project is lead by ITS Norway, and involves project partners in six countries. The county og Vestfold and Telemark is supporting the iniatitive and will be involved as part of a community of practioners.
https://its-norway.no/prosjekter/orchestra-an-h2020-project/

The county council has been using signal prioritisation for public transport in Tønsberg in the traffic crossings. The county is tendering a traffic management system for the urban area of Grenland, which in the first phase will give signal priority to the public transport, and can be extended to include more comprehensive traffic management functionalities. The county is furthermore exploring the possibilities for piloting different types, and uses, of sensors in relation to road-maintenance and surveillance.

Weser and Ems Region, Germany

BITS (Bicycles and Intelligent Transport Systems) with 10 beneficiaries from 5 countries (NL, DE, BE, DK and the UK) aims at implementing ITS (Intelligent Transport Systems) solutions that directly increase the take-up of cycling and reduce CO2 emission, while collecting and processing reliable and useful cycling data for policy-making. The project will kickstart ITS in cycling by:
- Implementing ITS solutions that directly increase the take-up of cycling (+10%) and reduce CO2 emission (-9%) within target groups
- Sharing cycling data and building a CyclingDataHub to share, analyse and visualise the data (>100 data sets)
- Use collected data to get better insight in the needs of cyclists to drastically improve cycling policies
- Integrate the ITS methodologies and datasets into broader multi-modality, thus anchoring cycling in broader mobility policies and share this data for a multimodal future The demonstration of ITS applications and cycling data will allow others to use these cycling data for applications and policies. The effectiveness of ITS solutions will be evaluated, challenges identified and results disseminated to other regions.
The German Partners are the University of Oldenburg with the Department of Computing Science and Business Informatics as well as Baron Mobility, the provider of bike rental based in Oldenburg.

4.3. Innovative mobility concepts (Mobility as a Service, shared (micro-)mobility)

Aberdeenshire has been operating flexible demand responsive transport (DRT) for several years and is currently refining the operation and interaction of sample services through the Interreg G-Patra project which is provided free of charge to users.

Aberdeenshire has launched a number of shared e-bike schemes one amongst employees and one along a core cycle path with the cooperation of local community organisations

Aberdeenshire has a network of bike counters throughout the region

Aberdeenshire also has similar projects to Västra Götaland's projects for e-bike trials and school travel plans.

Region Västra Götaland's public transport provider Västtrafik has developed an app called **To Go** - a ticket system for Mobility as a Service (MaaS). The app makes it possible to buy monthly or single tickets to where and whenever you want directly on the phone. This solution among public busses is a way to create and implement innovative mobility solutions. Västtrafik and sixty companies discussed the goal of creating a digital platform and an app with smart services linked to public transport, such as carpooling services, bicycle rental etc. The project is a living product and the discussion is continuing for developments. Furthermore, Västtrafik discussed with the companies to understand technical possibilities and potential business models. The most important component when talking about combined innovative mobility solutions is that there are considered standards, especially when many partners work together to create a well-functioning product.

Møre og Romsdal County: FRAM has tested flexible demand responsive transport (DRT) for several years. Generally, we have tested the service in rural areas. The most important experiences are

- The service reduces overall costs compared to traditional bus transport. Costs pr passenger can be high, but with few passengers in the rural area, there are savings compared to traditional bus operations. We have no experience with costs/ savings in urban areas.
- Customers achieve better public transport service compared to traditional bus transport
- The booking tool is a critical success factor. A weak tool makes the customers less likely to book a transport.

A number of commercial companies have conducted limited tests involving bikes for hire, electric scooters and so on. However, our urban municipalities are all adopting SMART City solutions, which in time and in collaboration with FRAM will include a variety of multi-modal mobility solutions.

North Denmark Region:

NABOGO (CAR-POOL APP)

Car-pooling is the solution to many challenges. In average, there is only 1,05 persons in one car, which results in too many cars on the roads and a much higher emission of CO_2. By sharing cars with each other, we are more likely to reduce the emissions, and less cars will result in faster journeys and more space for parking. NaboGO is a car-pooling service to everyday activities and commuters, targeting the trips from village to city, business parks, and stations. NaboGO cooperates with the municipalities, educational institutions and workplaces in order to disseminate the service, and to promote a greener and free alternative to driving alone in a car.

One of the main differences from other car-pooling services, is that NaboGO predefines specific meeting points in order to facilitate easy and fast coordination when using the service. It creates a

new infrastructure and better mobility in the areas where such a meeting point is defined. NaboGO is embodied in the Danish Travel Plan, which is an app that shows the possibilities of public transport from A to B. It is therefore interconnected and fitted to the possibilities of public transport, so it will be possible to take part of the trip with NaboGO and another part with bus or train. It creates a more flexible choice of how to get from A to B.

Read more about NaboGO here: https://nabogo.com/om-os/

MY TRAVEL PLAN

MinRejseplan (My Travel Plan) is the result of the further development of Rejseplanen (The Travel Plan) which is an app where it is possible to get an overview of how to get from A to B with public transport, including a time schedule and route of every bus, train and metro in Denmark. In MinRejseplan the public transportation forms are combined with car-pooling such as GoMore, city bikes, and city cars options. This means they appear in the options from getting from A to B along with the conventional transportation forms. MinRejseplan creates flexibility in transportation choices and gives the user an overall overview of the many choices that exist on one platform instead of many.

Read more about the app here:
https://play.google.com/store/apps/details?id=de.hafas.android.nt&hl=da

PLUSTUR AND FLEXTUR

Plustur is a car-pooling service, which means that the small bus drive with more than one passenger, and that the trip from A to B often will be longer than the direct way. Plustur can only be used in connection with a journey where bus or train is incorporated. This means that Plustur will not take the passenger all the way from A to B, put only a part of the journey. In this way, Plustur is meant as a connection between rural district without bus connections, and to the nearest prioritised public transport system. Flextur on the other hand is the same concept but can be booked from one address to another if needed. Flextur is meant as a means of transport when there is no bus route from A to B. Flextur and Plustur can be booked via the Travel Plan app, and the price is the same as a normal bus or train ticket. Plustur and Flextur are provided by the PTA, Nordjyllands Trafikselskab in collaboration with the North Denmark Region.

See the video on how it works here: https://virejsersammen.dk/

HAVBAKKEBUSSEN (RURAL DISTRICT BUS)

In a rural district in Mariagerfjord Municipality a work group consisting of the PTA and voluntary citizens, has initiated a project with the purpose of making the area more attractive to reside in. It is a challenge for the PTA to provide coherent, regular and flexible public transport to rural districts that are sparsely populated. A shared car and a shared bus have been provided for the residents in the rural district to borrow and use when needed to get around. A local work group has been established, and they manage bookings of the car/bus, and help provide driver if needed. The project is meant as a supplement to the public transport in order to solve the low mobility possibilities in rural districts.

Read more about the project here: http://www.havbakkebussen.dk/Forside.html

Vestland County

Vestland County and Skyss is piloting the concept "HentMeg" ("Pick-me-up") in the rural town of Odda since February 2020. This is a concept of dynamic transport, based on a similar concept in Sauda in Rogaland County. The pilot works well and will be evaluated by the end of 2020. "HentMeg" is a service for digitalized bus booking. The passenger books the bus, instead of driving at a fixed time table. Customers book the bus with an app or by a manual phone call to Skyss customer service. During Covid-19 our experience is that this concept requires far less resources compared to traditional adjustment in a situation of changing travel demands. However it takes time for the customers to establish new habits. The concept seems to be not yet very popular among the elderly customers, but we will keep our focus on this in the months to come. SpareLabs (Silicon Vally, USA) is our partner in piloting the concept.

Testing of a similar concept of dynamic bus services for senior citizens in Bergen is planned to be conducted in early 2021.

The City of Bergen is offering shared city bikes. This is a very popular service widely used by the people in Bergen. Several municipalities in the Vestland County are considering similar bike services in their town centers.

https://www.skyss.no/Verdt-a-vite/Nytt-fra-Skyss/hent-meg-er-opna-i-odda/
https://bergenbysykkel.no/

Region of Southern Denmark

Flex-traffic (New mode of public transport)

Flex-Traffic is a mode of public transport, which directs users unable to use the common modes of public transport (such as elderly citizens, disabled citizens or citizens with difficult access to the common transport network). It is characterised as a demand-controlled mode of collective transport with smaller vehicles (taxis and 8-person-busses) and the transport is scheduled due to the individual transport needs and not due to a timetable, which is known from average bus traffic. There are no ordinary stops and the transport is individually designed from address to address due to the customer's need. The term 'Flex-traffic' is a public designation for a range of transport possibilities, which represent the demand-controlled public transport.

Flex-traffic differ from transport by taxi in the way that:

- Customers travel with other customers (and potentially customers they don't know). If there are more Flex-traffic reservations in a certain area, which the same flex-car can combine meaningfully, the ride is prolonged, because pick up of other passengers are potentially made.
- Customers pay per 'ticket'/ not per car. The fee is per kilometer/per person, but only for as many kilometers as the individual customer's own travel need advises (address to address).
- The transport has to be ordered no later than one/two hours before the transport is done
- The fees vary from municipality to municipality, because the municipalities financially support the flex-traffic differently.

There are roughly 5 various forms of flex-traffic (although regional and municipal variations exist) of which the three first are public supported/free of charge.

Transport for disabled - to guarantee disabled citizens a collective transport option although they may not be able to use bus or train.

Municipal transport schemes – to citizens who need to attend doctor or hospital, but who cannot use common collective transport modes.

Patient transport - a regional transport scheme for citizens who are attending treatment at hospital, but who cannot use common public transport modes.

Flex-trip - can be used by everyone as an alternative to bus or taxi and where transport is made from address to address. Transport will most typically be coordinated with more transport needs in the same area, which can make the trip a little longer, but for a significantly reduced fare (compared to taxi).

Tele- taxa – in geographical areas where the critical mass is low and there are no public busses tele-taxi can be applied as an on-demand 'buslike' transport from address to the next bus stop.

Groningen and Drenthe have a Hub program for over two years now. These Hubs are multimodal nodes throughout the region (32 in Groningen and 23 in Drenthe) in and around the cities but also in more rural areas. These are the places where you can switch from your car or bike towards the main public transport routes or for instance from your car towards a shared bike system that can bring you into the inner city center. These Hubs are strategically located in such a way that there is always a Hub within 15 kilometers of your home. They are more than just regular transfer nodes, with a higher quality and combined functions for drinks and food for instance. These Hubs are also the main points for our regional programs for MaaS solutions and Shared Mobility. Groningen and Drenthe are one of the seven national MaaS pilots and in Groningen there is a growing use of shared mobility solutions like bikes, steps, scooters and cars. Furthermore the Hubs also play a key role in the coverage of a regional plan for charging stations.

Overview of the Hub locations in Groningen and Drenthe.

Rogaland County:

On-demand bus service was developed by Kolumbus, the public transport company in the region, for operations in the municipality of Sauda in Rogaland. This system has later been extended to other counties in Norway.

In 2018 Rogaland county council started up the EU Horizon2020 project TrAM as coordinator. The project is managed by Kolumbus and includes 13 partners across Europe that will develop modular design and manufacturing methods for zero-emission vessels. Part of this project is to deliver a "demonstrator" vessel that will operate an existing fast-ferry route around Stavanger from 2022. The vessel will be fully battery electric.

A pilot project for car-sharing of 10 electrical cars is in operation in Stavanger. The project was initially open for work and private car use for employees of companies in the "Innovasjonsparken" area at Ullandhaug, Stavanger.

A Mobility as a Service (MaaS) is partly developed by Kolumbus to include various mobility services such as buses, boats, trains and city bikes into one common digital platform for ticketing and route planning.

City-bikes are implemented by Kolumbus as an integrated part of the mobility services in Rogaland county council. Approximately 750 electrical bikes are rolled out in the cities and municipalities in Rogaland and more bikes will follow in 2021.

Vestfold and Telemark county

Vestfold and Telemark county is responsible for the public transport in the region. The public transport run by the county includes bus transport, ferries for persons- and cars, and soon a city bike service in the urban area of Grenland (pilot) and a kick-bike service in Tønsberg (pilot). The aim is to add mobility services and functions to the ticket app over time (combined mobility), with a view to offer attractive sustainable transport alternatives, and reduce the dependence on individual cars.

The region is running several pilots on the concept of demand-responsive transport (DRT) on locations like Horten, Re outside Tønsberg and Bø. The idea is to test if- and how- demand-responsive transport (DRT) can be a possible solution to satisfy the mobility needs in sparsely populated areas where regular public transport is usually not feasible on financial grounds. The background is often that the demand-responsive system is replacing a fixed bus line. The aim is to provide mobility which is unreliant of individual cars, through achieving a more flexible public transport service in a cost-efficient manner, and to test new technologies with digital solutions from Spare Labs and Go Mobile. The experiences so far are mixed. In Bø the amount of passengers increased by 20 percent. But the other services have not resulted in the same passenger increases. It takes time for the market to learn about a new service and make use of it. In addition, it is not clear whether the service is more cost-efficient than a fixed line. The experience is that many of the senior passengers, which is a target group for the service, order their trips by calling the customer service. The county government has decided to prolong the pilots to be able to gather more experience with these types of services.

The county government will be involved in a pilot on shared electric kick bikes in Tønsberg together with Bovi mobility, a local start-up company and the municipality of Tønsberg. The aim of the pilot is to explore how micro-mobility can make the inner city more accessible, and to supplement the public transport and make people less dependent on individual cars. The pilot will make use of geofencing as a means of regulating the speed of the kick bikes, as limiting the speed will enhance traffic safety. The public transport company will make the micro-mobility offer available in the ticket application of the public transport company.

Mountain elevator connecting the up-town with the down-town area – a "smart" public transport offer

A unique new railwaystation was built in the heart of the mountain in the town of Holmestrad was opened in 2016. The station is accessible from the city centre through a foot tunnel and from the mountain plateau via 70-meter-high lifts. 90% of the population of the town lives on top of the mountain. The elevator gives easy access to the railwaystation and the downtown area, and replaced an existing busline. The trip takes 40 seconds and is free. The elevator is co-financed by the state, the county and the municipality. This has proven very popular, both with people who are taking the train, or people using the elevator for going down-town Holmestrand. The elevator takes 60 people at the time.

Weser and Ems Region, Germany

NEMo: "Sustainable satisfaction of mobility demands in rural regions"

Due to the demographic change, it becomes increasingly difficult for counties and municipalities to ensure a basic supply of public mobility services such as bus and train without asking the question of necessary social participation, meaningful regional creation of value and last but not least feasible environmental objectives. Here, the need of mobility will increase further in rural areas due to the accumulation of medical facilities and shopping centres in urban areas. The local public transport companies already facing the challenge to reliable ensure access to jobs and training places, schools, health centres and recreational facilities from the countryside. Considering this problem situation, the research project NEMo promoted the development of sustainable and innovative mobility services based on business models for rural areas. NEMo aimed at development of new mobility services, where citizens become mobility provider. For example, individuals could additionally operate rarely served stops of public transport with their own car to pick up other people. A higher person utilisation of private cars can close supply gaps and reduce the total volume of traffic and its negative environmental impacts.

To plan and manage these new rural mobility services information and telecommunication technologies is essential. From the beginning, citizens and public mobility providers have been

involved in the project to take into account actual needs and obstacles. Particular attention was given to the coordination and networking of all stakeholders, in particular the self-organization of citizens (e.g. carpools and neighbourhood cars). As a result of the project, a mobility app called „Fahrkreis“ has been developed giving the best mobility options for the citizens. The app was officially presented in February 2020 at the final conference of the project.

NEMo was funded by the VW foundation with €1,53 m. and scheduled for 3 years.

Source: https://nemo-mobilitaet.de/blog/en/project/projectinformation/ (13.11.2020)

Örebro region, Sweden
Bus Rapid Transit (BRT)
In the Örebro region's largest city, Örebro, planning has begun for the introduction of BRT-Bus Rapid Transit.

The investment is judged to have the absolute greatest effect on public transport in Örebro and will create a capacity-strong and efficient public transport system that has the ability to move more people without taking up more space.

Örebro is planned based on a holistic approach, where traffic is seen as part of the city. The starting point is to ensure that people and goods can reach their goal points. It is about making the city accessible to everyone and that the focus is shifted from thinking about the accessibility of vehicles to creating space for people.

The overall goal is to develop a capacity-strong public transport system and a long-term sustainable traffic situation in Örebro. It will increase the conditions for people and vehicles to cooperate in traffic and it will be easier to travel and move around in Örebro.

The BRT line will consist of several routes that will extends throughout the city. The first stage will start construction in 2021 and is expected to be completed in 2025. The longest distance is estimated to be 7 km long. The busses will have their own lanes.

Illustration of BRT in the city of Örebro.

Project goals

• reduced travel time by at least 30% between the respective end stop and the central bus station.

• increase public transport travel in the BRT route by 40% 3 years after the start of traffic

Information about the project: https://www.regionorebrolan.se/sv/resor-och-kollektivtrafik/vi-utvecklar-kollektivtrafiken/snabbussar/

Fosilfritt 2030 – Rena Resan / Clean Journey

The Clean Journey or "Rena resan" is a project that will help residents of eastern Central Sweden to use their climate impact from travel. By showing the benefits of cycling, walking or using public transportation, the project wants more people to start traveling sustainably. The Clean Journey is a collaborative project and is supported by the European Regional Development Fund.

The project is expected to lead those who today do not travel by public transport or by bicycle to start traveling more sustainable. The activities that will be carried out in within the project are try-out campaigns and physical nudges.

The try-out campaign will target work commuters and focus on a combined mode of travel, such as a folding bike together with public transport.

Physical nudge means changing the physical environment in some way to make it easier for individuals to do the right thing. This can, for example, mean making a cycle path clearer by painting the asphalt or improving the signage.

The Clean Journey is a collaborative project in which the Örebro Region participates together with actors from regions in central Sweden.

Commuters trying alternative transport modes - in this case electric scooters and electric bicycles

Information about the project: https://projektetfossilfritt2030.se/rena-resan/

4.4. New transport modes and test facilities (hyperloop/ pipeline, cable, drones, etc.)

In **Aberdeenshire** drone technology is in use to inspect and monitor components of the road network. Regional health services are investigating the use of drone technology for particular health related logistics in the region.

Aberdeenshire have a similar project to the Future Transport (Framtida transporter) of Västra Götaland called EASTiE – Embedding Active and Sustainable Transport in Education -

https://www.aberdeenshire.gov.uk/media/20952/embedding-active-travel-in-education_resources-for-teachers_0.pdf

Region **Västra Götaland** has financially supported the project **AstaZero,** a test facility in Borås. AstaZero is the world's first full-scale independent test environment for future road safety. The facility is unique in that the different traffic environments make it possible to test advanced safety systems and their functions for all kinds of traffic and traffic situations. This enables research, development and certification of future road safety systems, and it functions as an international arena open for vehicle manufacturers, suppliers, legislators, universities and colleges from throughout the world. The name is a combination of ASTA Active Safety Test Area and Zero, which refers to the Swedish Parliament's vision for road safety with zero dead and seriously injured in traffic.

Region Västra Götaland has also worked to electrify the bus-system through a project called **ElectriCity**. The project includes a platform for the development and testing of services and products that can contribute to more attractive public transport. The work has gone from developing and testing to scaling up the bus systems in the city traffic. To accomplish the work, the region has collaborated with bus manufactures, researchers and society.

Region Västra Götaland also has a knowledge centre called **Triple F** that develops more efficient freight transport. The centre is coordinated by Lindholmen Science Park. The city of Borås is involved in an Interreg North Sea project called **SURFLOGH**. The main goal of the project is to achieve a more efficient cargo distribution in urban areas and thereby maintain efficiency in long-distance transport. Furthermore, the research institute RISE has built a centre for electro transport: SEEL, Swedish Electric Transport Laboratory AB.

Sustainable Travel West – project platform

Sustainable Travel West (Hållbart resande Väst) is a competence and project platform for sustainable travel. Region Västra Götaland, together with Region Halland, municipalities, Västtrafik, Hallandstrafiken and several more want to increase the proportion of sustainable journeys in Western Sweden.

Below there is a list of some projects under this platform initiated by Region Västra Götaland (full list here):

- **Bus Ahoy!** is an investment to make more people discovering the benefits of combining folding bicycle and public transport for their trips.
- Bicycle friendly working place (Cykelvänlig arbetsplats) is an annual bicycle project with competition elements. The project aims to get as many people as possible to cycle to and from work by employers working to become as bicycle-friendly as possible.
- Future Transport (Framtida transporter) is a school project to engage and create an interest in transport, transport systems, technology and sustainable development among students in 7-8 grade – and thereby contribute to a sustainable future.
- KomILand is a project for sustainable travel in rural areas and smaller urban areas through combined mobility. KomILand is financed by the Region Västra Götaland and Vinnova.

North Denmark Region:

PIPELINES AT NEW UNIVERSITY HOSPITAL AALBORG

A new pipeline system between Hospital North to the laboratory at Hospital South in Aalborg saves both time, taxi and CO_2. The system makes it possible to send samples of blood, urine, and cerebrospinal fluid between the two hospitals in just a couple of minutes, whereas before the samples were carried with taxi several times a day on a heavy trafficked road. The pipeline is the world's longest with its 1.650 m., and it was inaugurated in December 2016. The pipeline is buried underground, and the samples are carried with compressed air. In this way, it only takes 3-4 minutes for the samples to reach the laboratory, which benefits both the treatments that are dependent on fast test results and the environment. It is the North Denmark Region who is behind the initiative.

BRT (BUS RAPID TRANSIT) IN AALBORG

The Municipality of Aalborg is planning the opening of a new BRT system in Aalborg to support the rapid and continuous development of the city. The project will create coherence and furthermore solve many of the current challenges in the city center traffic, among these, the growing number of cars and their cause of tailbacks. The BRT will have its own bus lane and be prioritised in traffic lights. It will be 25 m. long, and there will be space for up to 200 passengers. It has been a priority to make the journey as comfortable as possible with reduced noise, an emission-free bus, fast entry and exit (under 20 sec.), and only 7,5 min. between each bus. The BRT is expected to be in operation by 2023.

Read more about the BRT here: https://plusbus.dk/om-plusbus/

Groningen (Northern Netherlands): Starting in 2022 even a fifth modality is added to the autonomous transport program with the planned opening of the first European Hyperloop Center in Groningen. In this center parties from all over Europe are welcome to test and further develop the Hyperloop concept. A lot of knowledge will be conducted as well and in the pipeline tests with a small version of the Hyperloop can be done for freight transport (www.hardt.global).

Impression of the new European Hyperloop Center in Groningen.

Region Örebro County

Electrification of freight transports

Region Örebro County is one of two regions included in the Swedish Transport Administration's electrification program. The aim is to build up a national electricity infrastructure for freight vehicles on the road, both in terms of electric roads and charging infrastructure to reach a fossil-free transport system by 2045.

Link to the Swedish electrification programme: https://www.trafikverket.se/resa-och-trafik/forskning-och-innovation/aktuell-forskning/transport-pa-vag/elektrifiering-for-tunga-transporter/

Illustration: Example of a technology for electrifying is electric highways

HCT DUO PILOT PROJECT

Örebro Region County, together with several actors, including the network CLOSER, Örebro University and product owners in the region, have applied for a permit from the Swedish Transport Agency to be granted to drive longer vehicle combinations on the road.

In the pilot test, a vehicle combination that is currently not permitted in Sweden will be tested on the section between Hallsberg's railway combi-terminal and logistics areas in Örebro. The goods transported on the trucks are transported by rail between Hallsberg and the port of Gothenburg. Thus, this has pilot test multimodal perspective.

The aim is to develop knowledge about system effects (benefits and risks) through the introduction of HCT solutions for multimodal freight transport. In doing so, we want to accelerate the introduction of HCT vehicles in Sweden in order to strengthen the business community's competitiveness and contribute to overall sustainability goals.

More information: https://closer.lindholmen.se/en/focus-areas/long-distance-multimodal-freight-transport

5. Vehicle manufacturers and/or technology developers/providers

This chapter provides information of significant vehicle manufacturers and/ or technology developers/providers within innovative mobility solutions operating in the North Sea Region.

The below list gives some example of vehicle/technology developers/provides within the **Region Västra Götaland**:

- **Volvo Cars**

- **Volvo AB**: more than 100,000 employees, with 12 brands and 190 markets. Production facilities in 18 countries. Trucks, buses, construction equipment and marine and industrial engines. Complete solutions for financing and service.
- **Polestar**
- **Geely innovation centre**
- **CEVT**: China euro vehicle technology
- **Ericson**: develop of mobility service
- **T- engineering:** based in Trollhättan and is a vehicle development owned by Dong Feng China
- **Nevs**, Trollhättan
- **Einride AB**: A Swedish transport company specialising in electric and self-driving vehicles known as Einride pods (formerly T-pods).
- **ST1**: Energy Company
- **Preemraff Lysekil**: an oil refinery.

There is also a large number of consultancy firms working in the transport sector.

Møre og Romsdal County: Apart from Doosan Moxy Trucks, there are no significant vehicle manufacturers in our county. Nor is the technology development/provider environment significantly different from the rest of Norway.

Maritime sector:

The region has a strong maritime industry. The Blue Maritime Cluster, a Norwegian global centre of expertise, is situated in our region. Rolls-Royce Marine (now part of the Kongsberg Group) is currently leading the way within autonomous ship navigation with their navigation system Auto crossing now operating on several ferries nationally.

North Denmark Region: Technology developers/providers within innovative mobility solutions:

1. **Ballard Power Systems** situated in Hobro works towards a greener future by developing zero emission fuel cells to vehicles such as buses, trains and ferries. Ballard delivers service of power products and technology solutions and have among other things delivered the fuel cells for the first Danish hydrogen buses.
2. **Hydrogen Valley** is a cluster organisation, which consists of various companies working within technology solutions with hydrogen and biogas, among others, Ballard. Their mission is to develop solutions with hydrogen and biogas that can advance the green transition in the Danish energy system, such as innovative and green technology for new mobility forms.
3. **Blue World Technologies** is an advanced developer and manufacturer of methanol fuel cell components and systems as a green alternative to the combustion engine. They are focused on developing a simple system design with high conversion efficiency and compliance with automotive design requirements. Their solution provides a vehicle with long range, fast refueling, zero harmful emission and a low fuel cost.

Vestland County: Several new businesses are focusing on Vestland County and cooperate with the municipalities and the county to co-create flexible travel solutions for the citizens. New businesses in the region have solutions for, for example, charging electric bikes and scooters, such as Altered Power. Nivel has solutions for controlling micro-mobility placement and Applied Autonomy supports and pilots self-driving vehicles. Vestland County and the City of Bergen are in dialogue with several of these stakeholders, and various concepts are being planned.

The City of Bergen has come a long way in facilitating good mobility with so-called mobility points. A mobility point is a physical hub where different travelling modes meet, like public transport, city bikes and shared cars. The inclusion of scooters is in process. The City of Bergen recently won a global award for its mobility and car-sharing solutions – read more here link.

https://bildeleringen.no/aktuelt/
https://www.bergen.kommune.no/hvaskjer/bymiljo/bergen-tok-bronseplassen-i-bildele-karing

Groningen has a huge startup scene (the biggest after the city of Amsterdam in The Netherlands) and also several smart mobility companies. Most of them are working together within the earlier mentioned hive.mobility network. A short overview with some of these companies:

- Arriva
- Qbuzz
- Century Car Group
- Hitachi Capital Mobility
- Demcon
- Groningen Bereikbaar
- Robottuner
- OV-bureau Groningen Drenthe
- Holthausen Clean Energy
- Hardt Hyperloop
- Marinminds
- Dronehub Groningen Airport Eelde
- OmniDrones
- Horus
- Hyundai
- Groningen Seaports

In Drenthe there are two main clusters of companies, one around the TT-circuit in Assen and one more industry related around the city of Emmen.

Vestfold and Telemark county

SAMS Norway is the Norwegian business cluster for autonomous mobility and transport systems, with a branch at the University campus in Horten. There are several initiatives and projects at the University of Southeast Norway (USN). USN is also operating a national maritime test center for autonomous vessels. USN include an Institute for Maritime Operations (IMA). On the research side they are engaged in a number of larger R&D project like: Autostrip (Autonomous systems in transport), RAPP- Autonomous passanger ferries, Water shuttle ("Vannbuss") in Tønsberg, Sandefjord and Drammen, Autonomous logistics like Yara Birkeland, ASKO, Smart condition Monitoring- SCM, Portbin Robot (Autonomous garbage collector for maritime applications).

There are several companies and actors who are involved in smart mobility activities, a few examples are: Kongsberg maritime, with a branch in Horten, is an international company developing autonomous shipping and logistics systems and more. Industrial Green Tech is a cluster with several large industrial companies in Grenland, like Equinor (energy group, oil and gas) , Yara Porsgrunn (fertalisers), Eramet (steel), Inovyn (pvc, alcaic materials), Ineos (polytethylen/ plastics). The

industrial Green Tech has developed a green transport strategy for their cluster. The Herøya industrial park has ambitions to develop automated logistics and transport chains on site, and to transport persons and freight to and from the industrial park. The harbours of Grenland/ Langesund and Larvik are substantial logistical actors in the region.

6. Regulatory framework or incentives

Denmark

A description of national regulations on automated/autonomous transport

Definition

An autonomous motorised vehicle is defined in Danish context, as **an EU type-approved or nationally approved motor vehicle which is technically designed to be able to drive completely or partially without a driver** (retsinformation.dk, §92f).

If an autonomous motorised vehicle is driven in accordance with the above mentioned, without a person physically having full control of the vehicle, the vehicle may only be used for ordinary traffic on roads covered by the Danish Road Traffic Act (see the law in Danish) if the Minister of Transport has granted permission to experiment with this pursuant §92h in the Danish Road Traffic Act (retsinformation.dk, §92g).

Rules regarding experiments

Experiments with autonomous motorised vehicle **must be completed on specific stretches of road and can be limited to specific times during the day**. The experiments must always be **carried out safely in regards of road safety**. The experiments must, according to the beforementioned, have **participation of a physical person** who can take over the wielding of the vehicle when this is instructed by technical device of the autonomous vehicle or when the person assesses that there is a need for it. The physical person must have a acquired a driving license of the vehicle category for the vehicle category in question and must comply with the rules regarding drink-driving and driving under the influence of drugs that affect consciousness. The physical person can either participate as driver or operator of the autonomous vehicle. An operator in this context is a person who participates in the experiment but who is not present in the vehicle while driving (retsinformation.dk).

Permission

The Minister of Transport shall, after consulting with the road authority and the police, grant permission for experiments in accordance with the Danish Road Traffic Act regarding experiments with autonomous vehicles. The Minister of Transport impose the detailed conditions for the experiments with autonomous vehicles (retsinformation.dk §92h).

Permission for experiments with autonomous motorised vehicles is **granted for a period of up to two years**, and can be renewed by the Minister of Transport after consultation with the road authority and the police. Furthermore, the Minister of Transport may at any time revoke a permission with the effect that the experiment must be brought to an immediate end (retsinformation.dk).

Content of the application

An application regarding permission for experiments must be submitted to the Minister of Transport accompanied by a more **detailed description** of the experiment. The application must therefore

contain a **description of the motorised vehicles** which is included in the experiment, **a detailed plan** of the experiment itself, including the **levels of automation** involved, the **road conditions** on the road sections on which the experiment is expected to take place, and the **traffic and weather conditions** which is expected. Moreover, a **description of the organisation** of the experiment must accompany the application as well as a **thorough plan for the collection, registration, systematisation, storage, use, disclosure, integration and deletion of data** generated in connection with the experiment. The Minister of Transport can lay down further rules regarding requirements for the application, including which documents that must accompany the application (retsinformation.dk).

The Minister of Transport may order the applicant to provide security for expenses incurred by the public sector after completed experiments (retsinforamtion.dk, §92i).

Assessor

An application for a permit is accompanied by an assessment from an approved assessor regarding the consequences for road safety when carrying out the experiment. An assessor is a company or parts of a company that wants to work with assessments of experiment with autonomous motorised vehicles. **The assessor must be approved by the Danish Transport Authority.** The Minister of Transport may lay down rules on the approval of assessors, including the independence and competences, and on supervision of the approved assessors. Furthermore, the Minister of Transport may also lay down rules on confidentiality, his or her liability insurance and requirements for the assessors' subcontractors (retsinformation.dk and fstyr.dk).

The Transport Companies Act

The Minister of Transport may in connection with the determination of rules regarding the experiment, stipulate that the Transport Companies Act does not apply to the experiment. This can only be done after consultation with the transport company (retsinformation.dk §92j).

Violation of the law

When laying down provisions on experiments, the Minister of Transport, after consulting with the Minister of Justice, lays down rules on punishment, including provisions on the subject of liability for violations of the Danish Road Traffic Act. In relation to this, The Minister of Transport may, after negotiations with the Minister of Justice, deviate from chapters 17 and 18 in the Danish Road Traffic Act, which concerns sentences, tax, disqualification from driving, etc. Furthermore, the Minister of Transport can, after negotiation with the Minister of Justice, decide that a permit holder may be fined, even if the violation cannot be attributed to the person in question as intentional or negligent. The same applies to a legal person who is a licensee, even if no infringement has been committed within its business that can be attributed to one or more persons connected to the legal person or the legal person as such (retsinformation.dk, §92k).

Germany

Status and Conditions for Intelligent Transport Systems (ITS) in Germany (Status und Rahmenbedingungen für Intelligente Verkehrssysteme (IVS) in Deutschland). The report outlines the conditions for the introduction of ITS in the road transport and examines the links between ITS and other modes of transport according to the Article 17(1) of the EU Regulation 2010/40/EU.

1. **Regulatory framework**

The starting point for the regulatory framework for ITS is the Federal Coalition Agreement: "Future of Affordable and Sustainable Mobility". As a result, the Federal Government (esp. the previous

Federal Ministry of Transport, Building and Urban Development and the current Federal Ministry of Transport and Digital Infrastructure) has introduced several policy instruments to promote innovative mobility solutions, for example:

- *Law on Intelligent Transportation Systems*, 2013 (Das Intelligente Verkehrssysteme Gesetz), as an implementation of the EU regulation 2010/40/EU.
- *Status and Conditions for Intelligent Transport Systems (ITS) in Germany* (Status und Rahmenbedingungen für Intelligente Verkehrssysteme (IVS) in Deutschland), undated. The report outlines the conditions for the introduction of ITS in the road transport and examines the links between ITS and other modes of transport according to the Article 17(1) of the EU regulation 2010/40/EU.
- *ITS-Action Plan for the Roads to 2020",* (Nationaler IVS-Aktionsplan „Straße"), 2012. The Plan presents the approach to be adopted for the coordinated evolution of existing and the accelerated deployment of new intelligent transport systems to enhance road safety, improve the efficiency of transport and reduce the negative environmental impact of transport. The plan defines priority action areas to 2020 and measures for implementation.
- *Strategy for Automated and Networked Driving*, 2015 (Strategie automatisiertes und vernetztes Fahren) describes the status quo, potentials, aims, fields of action and implementation of automated modes of transport.
- *Mobility and Fuels Strategy*, 2011. (Mobilitäts- und Kraftstoffstrategie der Bundesregierung). The strategy addresses the following issues: the significance of natural gas, the roll-out of battery powered cars and the prospects for fuel cell powered vehicles as well as vehicles with "green" electricity or hydrogen.
- *Federal Programme for Hydrogen and Fuel Cell Technology* (Regierungsprogramm Wasserstoff- und Brennstoffzellentechnologie 2006-2016, 2016 - 2026). The programme presents how various ministries will promote the research, development and the implementation of hydrogen and fuel cell technology.
- *Electric Mobility Act, 2015* (Elektromobilitätsgesetz). The Act is an important component of the Federal Government's promotion of the market ramp-up of electrically powered vehicles. The Act allocates specific parking spaces to them at charging points in the public realm, reducing or abolishing parking charges and exempting these vehicles from certain access restrictions. To allow for easier verification, the vehicles are marked specifically with the so-called E registration mark.
- *National Cycling Plan 2020 (Nationaler Radverkehrsplan)* is the Federal Government's strategy for the promotion of cycling in Germany. It includes concepts, thematic focuses and concrete objectives that the Federal Government, federal states and local authorities as well as additional actors pursue within their field of responsibilities. One of the objectives is to promote cycling to become intelligent, smart and connected as well as urban cargo transport by bicycle.
- *Freight Transport and Logistics Action Plan.* The Plan puts forward goals and measures to support the freight transport and logistics industry. The goal of the Federal Ministry of Transport is, among others, promoting environmentally friendly and energy-efficient freight transport. In order to achieve it, a Logistics 2030 Innovation Programme was launched in 2019.
- *Cooperative ITS Corridor Joint deployment Rotterdam – Frankfurt/M. – Vienna*
  The EU Member States the Netherlands, Germany and Austria have signed a Memorandum of Understanding to realise an ITS Corridor in close cooperation. Two cooperative ITS

services are first planned for use in the Cooperative ITS Corridor Rotterdam – Frankfurt/M. – Vienna: Road Works Warning (RWW) and Vehicle Data for improved traffic management.

To shape the change towards ITS, the Federal Government has convened the *National Platform Future of Mobility (NPM).* The platform is comprised of six working groups dedicated to different topics related to transportation, with representatives from the business sector, politics, academia, and various interest groups (NGOs).

The aim of the NPM is to develop multi-modal and intermodal paths for a largely greenhouse gas-neutral and environmentally friendly transport system. The aim is to make passenger and freight transport an integral part of an efficient, high-quality, flexible, accessible, safe, resilient and affordable mobility system and to contribute to ensuring a competitive mobility economy and to promoting Germany as a centre for employment.

2. Incentives

The Federal Government (esp. Federal Ministry of Transport and Digital Infrastructure) has developed a number of funding programmes in order to set incentives for ITS in Germany in relation to (selection):

- electric mobility and charging infrastructure
- automated road and rail systems
- innovative port technology
- cycling
- urban logistics
- energy efficiency with regard to electric rail transportation
- hybrid and fuel cells technology
- hydrogen technology.

Further useful information can be found here:

https://www.bmvi.de/EN/Home/home.html (13.11.2020)

https://ec.europa.eu/transport/themes/its/road/action_plan/its_national_reports_en

(13.11.2020)

The United Kingdom/ Scotland

The Scottish government has a strategy for connected and autonomous vehicles launched in December 2019 which can be found

https://www.transport.gov.scot/media/46708/a-cav-roadmap-for-scotland-final.pdf

The UK Government had set a target of having self-driving cars on roads by 2021 and is supporting initiatives to enable the advanced trials of autonomous vehicles on the road network.

This includes the issuing of a new Code of Practice for automated vehicle trialing in February 2019 which states that vehicles will be allowed to test on public roads using a remote driver, providing that the remote driver is ready to intervene at any moment.

The Scottish Government has commitments to deliver LEZs in Scotland's 4 main cities (including **Aberdeen**) as soon as possible and to completely decarbonise the road transport sector by 2050.

Legislation permitting the establishment of LEZs and Worklace Parking Levies was included within the Transport (Scotland) Act 2019.

Region Västra Götaland: The Swedish government has introduced several policy instruments to get a create change in the area of innovative mobility solutions. For example, a carbon dioxide tax, Bonus Malus system for passenger car purchases (private cars class I and II, light buses and light lorries), support for charging infrastructure, investment support (Klimatklivet) reduction obligation for fuels.

As mentioned above, Region Västra Götaland work very closely with business, academia and the public sector on these issues. State financial support is usually received from the Swedish Energy Agency and Swedish's Innovation Agency, Vinnova. Region Västra Götaland's public transport service has formulated very high goals in its Environmental and climate strategy . As of today, the public transport in Västra Götaland runs on 96 % renewable energy.

The Netherlands

In **Groningen** and other places in the North of The Netherlands local governments are working on zero emission zones in the inner cities by 2025. This also means that we are working on smart logistic solutions as well. Furthermore there is a national framework for autonomous transport which is still based on pilots. We are working together with the Ministry of Infrastructure and Water management on a new and improved framework also based on our experience of over four years now with autonomous transport. There is also regional and national policy and legislation in the making on shared mobility solutions, MaaS and the Hubs. Another important part were legislations is necessary is the data component in Smart Mobility. This is also something we are working on within the national 'Krachtenbundeling' (see www.dutchmobilityinnovations.com). It includes privacy and security issues and for instance smart traffic lights, but also agreements about getting all the local and regional data stored and digitally mapped in a good way. This also includes mapping all the roads for multiple use.

Norway

Møre og Romsdal County: The Norwegian Public Roads Administration has provided a guide for Smart mobility. There is progress on version number two.

The state-owned company Entur, established in 2016, is providing a national hub for public transport information. They are working on developing services for ticket-sales across operators. There are standards for reporting bus routes etc, so Entur can publish the data.

The government has also launched several programs for e.g. innovative mobility services, like the contest "Smarter transportation", where Møre og Romsdal county was one of the winners, with the project mentioned under 1.

There are also collaboration between The Research Council of Norway and Innovation Norway for calls which can be used for mobility services, like Pilot-T.

Through the project "Smarter transportation" we are mapping the gaps in shipping regulations preventing the introduction of autonomous passenger transport by sea, and we work together with

the Norwegian Maritime Authority to adjust legislations to new technologies and navigation systems. Still, there are no complete regulatory framework for mobility services.

Vestland County: In Norway there is the environment agreement between the state, the county and the municipalities ("Byvekstavtalen") as a primary and foremost tool for achieving the zero growth target, so that investments / money used within the 4 focus areas (Walk and Bicycle, Public Transport, Entry Parking and Environmentally Friendly Technology and Innovation) will mainly be used for measures that reduce emissions. The goal of zero growth in passenger car transport is paramount.
Vestland county will get the funding and will, among other things, finance the construction of city lanes, access measures, reduced collective prices, tariff cooperation with VY on trains, walking and bicycle measures, driveway parking.

7. Annex

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