
Transport of the Future
ENTER

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Research Results of the Swiss Federal Roads Office

Drivers and Potentials

Business Models and Scenarios

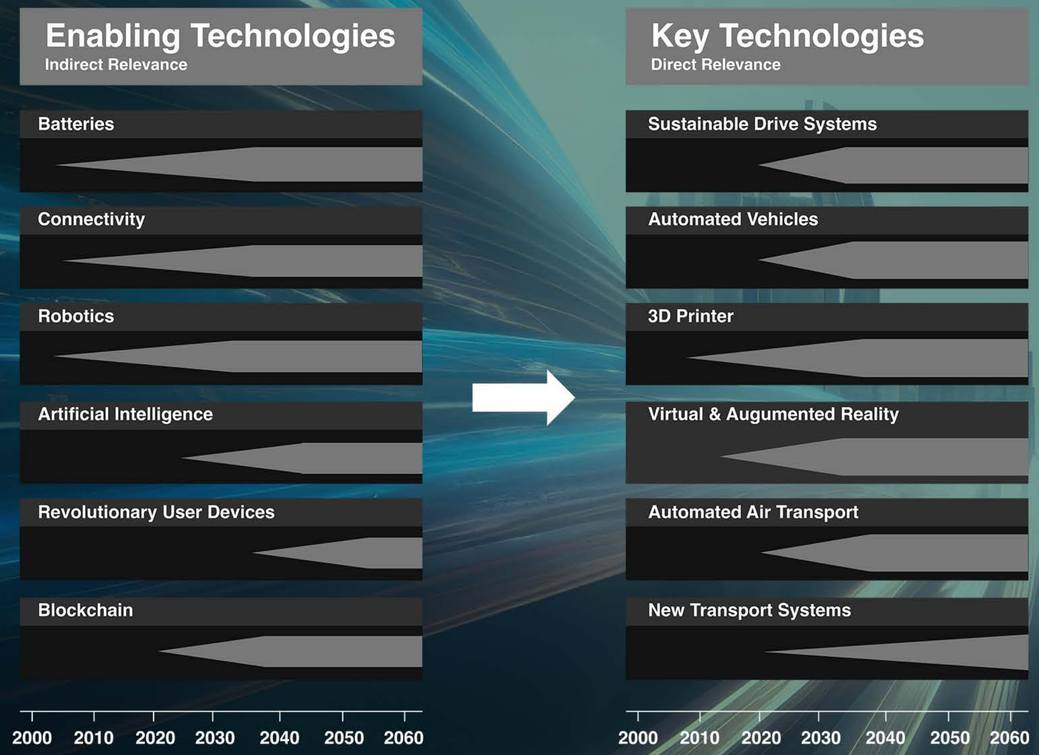
Transport of the Future

Disruptive Drivers

- New Technologies
- Urbanization
- Climate Change
- Aging

Driver 1: New Technologies

There are enabling technologies and key technologies. Key technologies are the basis for the disruptive potential of future transport.



Effects

Lower transport costs; Connection of infrastructure and vehicles and improved safety

Preconditions

Access to data and regulation of automated vehicles

Challenges

Long transition period towards full Automation;
Induced traffic;
Digital security

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Automated Driving

Safety and convenience are improved at level 4. But only level 5, ‘full automation’ without drivers, allows the use of robotaxis and roboshuttles and leads to a significant reduction in transport costs.

The 6 Levels of Automated Driving

0 NO AUTOMATION

Full manual control. The driver has full control over the vehicle and performs all driving tasks.

1 DRIVER ASSISTANCE

The vehicle can assist the driver with a single automated system.
(eg adaptive cruise control)

2 PARTIAL AUTOMATION

The vehicle can perform both steering and power control features.
(eg advanced driver-assistance systems - ADAS)

3 CONDITIONAL AUTOMATION

The vehicle can perform the majority of driving tasks. Driver involvement is still necessary.
(eg ADAS with environmental detection)

4 HIGH AUTOMATION

The vehicle can perform all driving tasks in certain circumstances.
(eg ADAS with environmental detection and monitoring)

5 FULL AUTOMATION

The driver is no longer necessary as the vehicle can perform all driving tasks without override.

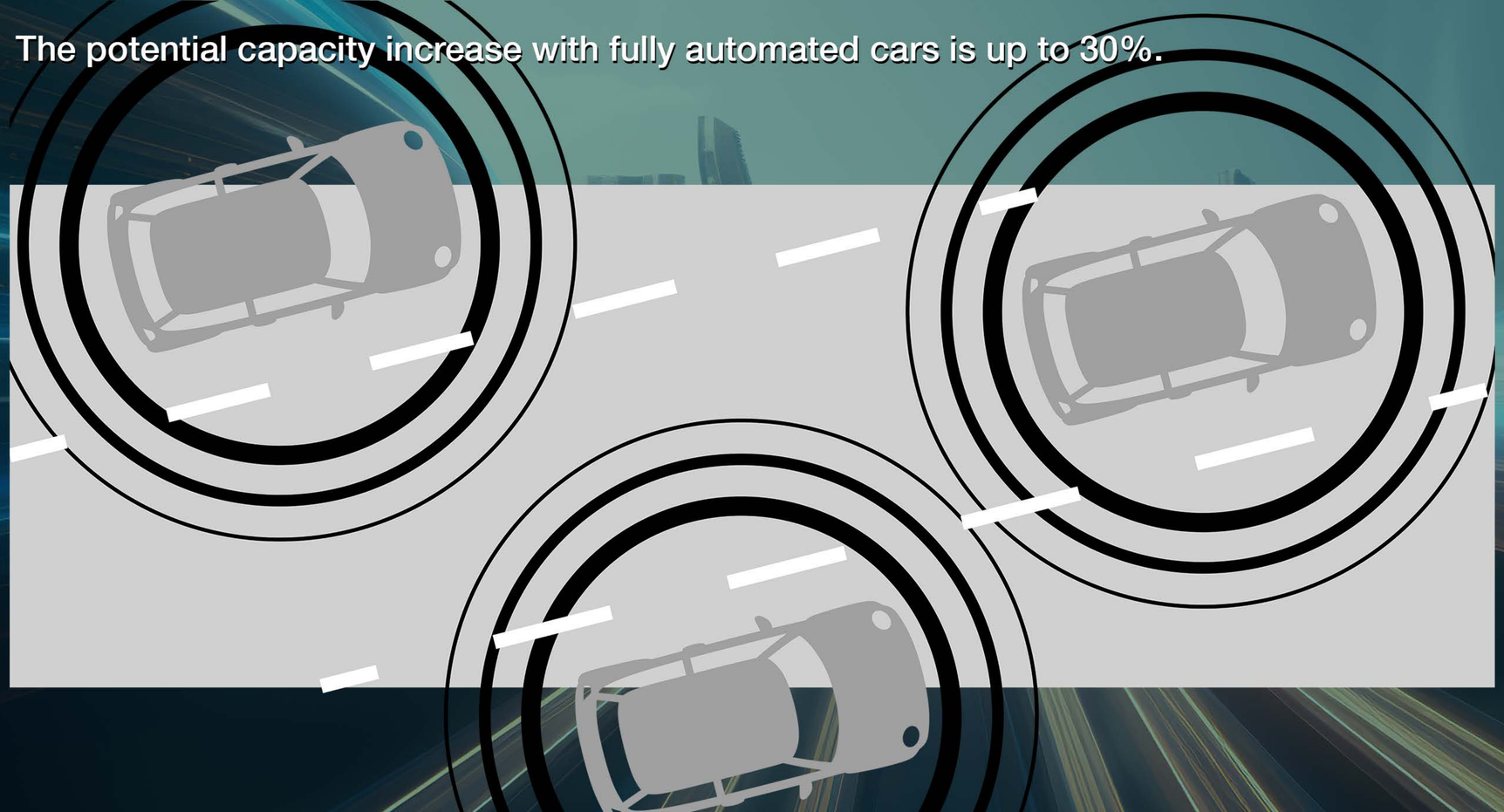
Learn more

Integrated Traffic Management

Connecting vehicle intelligence (in automated cars) and traffic management (by road operators) is essential to increasing road capacity.

This allows for optimal and harmonized speed, lane management and intersection management with AI algorithms.

The potential capacity increase with fully automated cars is up to 30%.



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Connectivity and Revolutionary User Devices

Connectivity and revolutionary user devices that link roads, cars and personal data provide the basis for mobility as a service to use the whole transport supply chain.

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New Logistics Systems

The Cargo Sous Terrain project aims to build an underground tunnel transport system for Switzerland. Initial drilling is underway. Cargo Sous Terrain is expected to be operational in the 2030s.

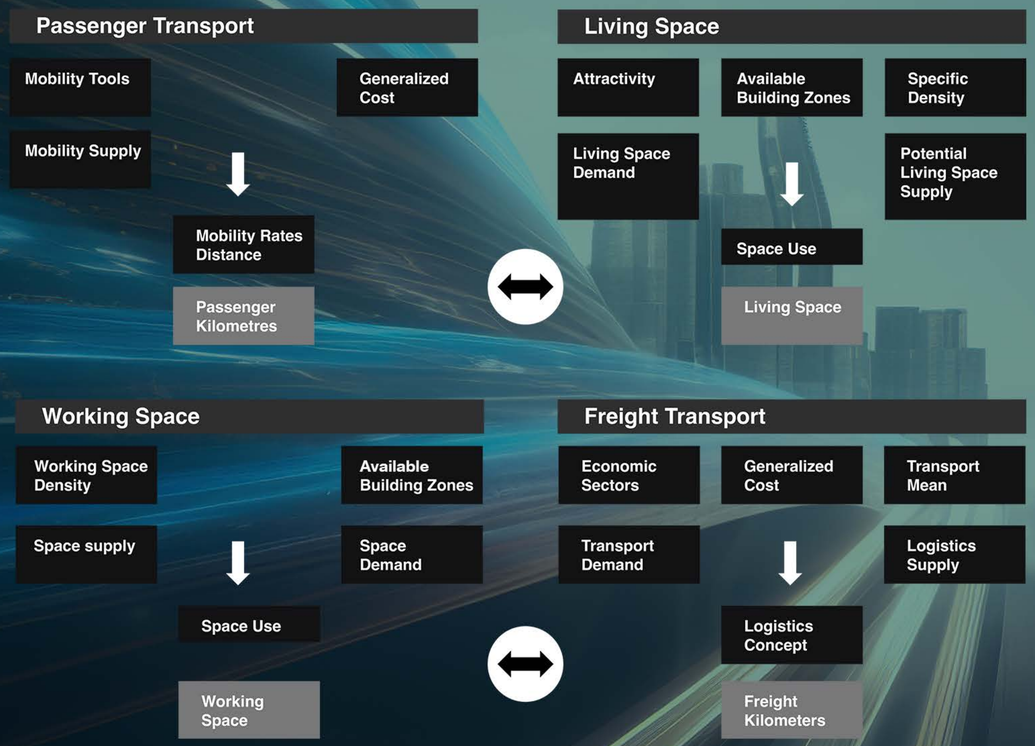
Cargo Sous Terrain follows a principle similar to that of an automatic conveyor system. Automated, driverless transport vehicles will operate around the clock in the tunnels, automatically picking up and dropping off loads from designated ramps and elevators. The vehicles, which run on wheels and have an electric drive with induction rails, travel at a constant speed of around 30 kilometers per hour in the triple-track tunnels.

Source: Cargo sous terrain

Back to menu

Driver 2: Urbanization

The interrelationship between spatial development and transport growth is crucial for exploiting economies of density in the transport sector.



Effects

Density, increased demand and supply for integrated multimodal services

Preconditions

Coordination of settlement and mobility

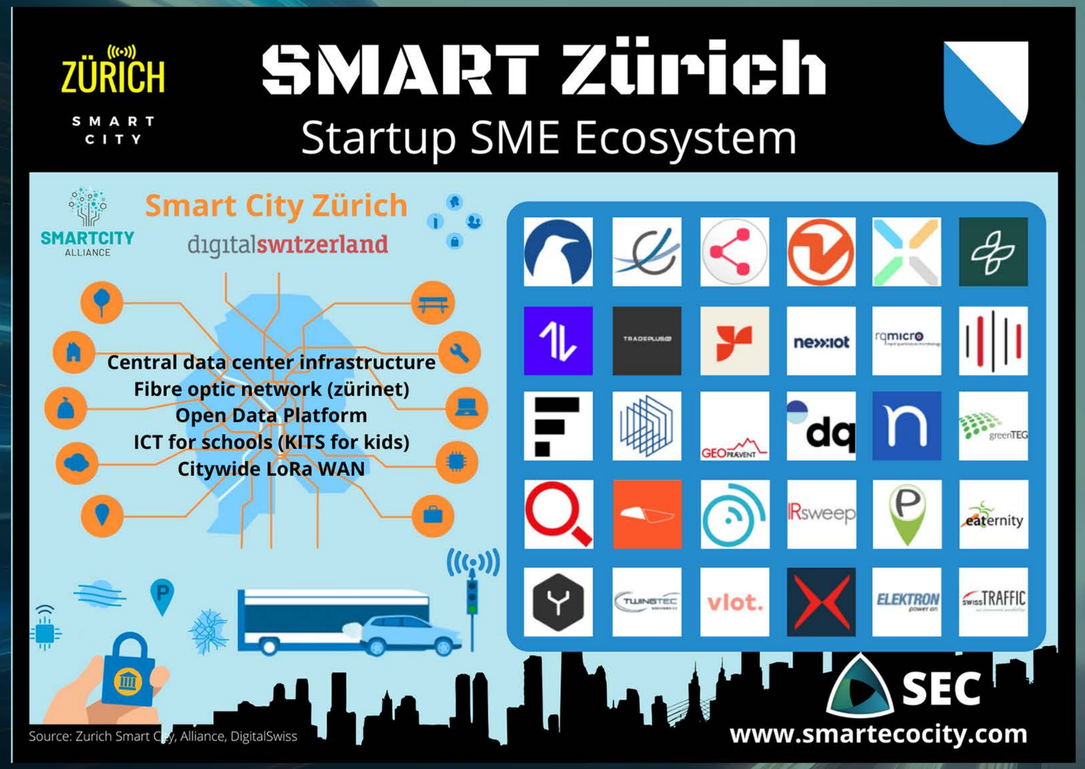
Challenges

Density stress;
Disaggregation of urban and rural transport policies: focus on agglomerations

Learn more

Smart City

The Smart City approach will integrate transport demand into general digital services.



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Driver 3: Climate Change

A global demand for sustainable transport is decarbonizing the transport sector. At the same time, rising temperatures and unstable weather conditions will change lifestyles and transport behavior.

Urban Areas

Strong demand for and increase in bicycle transport, negative safety impacts

Rural Areas

Searching for cool areas: Increase in leisure mobility demand and traffic peaks

Increased infrastructure cost (damage, heat resistant materials)

Pressure on rural areas, city escape, multiliving (summer, winter)

Mountain Areas

Positive impacts on day tourism, but winners and losers

Challenges:

Increased resilience of infrastructure; Electricity production (e.g. using roads to produce solar energy)

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Cool City – Sponge City

Water is the main cooling element for roads and squares in cities. This is resulting in new construction designs for road infrastructure and public places.

Turbinenplatz, City of Zurich

Back to menu

Driver 4: Aging

Future changes in demographics will have a major impact on transport design and demand.

Switzerland will grow (2020-50):

Increase in population: + 22%

Increase in share of population older than 65: 18% -> 29%

Increase in share of foreign nationals in population: 24% -> 35%

Basis: Official Forecast 2050 Swiss Federal Statistical Office

Effects

Increased demand in leisure traffic;
Early adopters of automated driving and multimodal services

Preconditions

Change of designs in traffic planning: Access and services for disabled persons

Challenges

Expectations for traffic planning and safety

Learn more

Aging and Transport Design

There are five major new transport service elements for the aged population:

1. **Institutionalized transport and escort services:** Transport offers aimed at people with disabilities, pick-up services for seniors, and transportation escort services.
2. **Accessibility of vehicles and related areas:** Disabled access, driver assistance systems, safe, step-free and weatherproof areas, visible and simple guidance systems.
3. **Integral offers:** Specific mobility packages for seniors (journey, pick-up service, tariff, ancillary services).
4. **Courses, training and campaigns:** To ensure adequate driving ability, the use of digital interfaces in public transport and the use of the various services.
5. **Inclusive design:** Aims to develop transport services and settlements (cities) in a way that takes into account all groups of people. Today, the focus is primarily on the working population.

Back to menu

Transport of the Future

Business Models

Scenarios

Challenges

Multimodal Business Models

There will be cohesion between individual, private and public transport.
Automated vehicles such as robotaxis and roboshuttles will significantly reduce the cost of services.

_Private Use

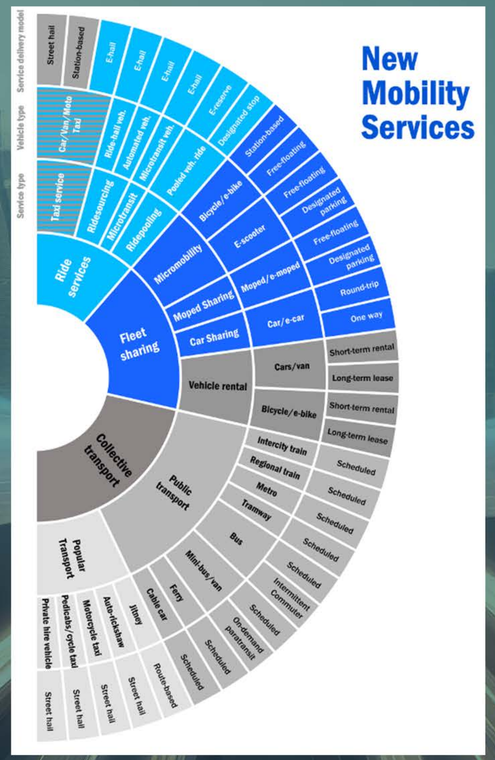
_Sharing (on demand)

_Riding (on demand)

_Public Transport (on demand)

_Public Transport (classic)

_Mobility as a Service



Source: adapted from SAE (2021)

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Business Models: Automated Car Sharing

With a greater proportion of automated cars, car sharing will involve:
accessing to robotaxis (individual, for long distances) or roboshuttles (collective use, for short distances).

√ Access at home

√ Flexible fleet

√ Low Cost

Do I still need my own car?

Back to menu

Scenario 1: Evolution without disruption

‘Everything is getting a little easier’

‘I still love driving my own car: no more traffic jams and parking hassle’

‘For short distances, I have my e-bike’

‘Public Transport is still the backbone, especially in urban areas’

‘Decarbonized, but no revolution: a car is still a car’

‘Noise barriers are solar power plants’

‘Track-guided e-buses: a new element’

‘Mobility assisting systems are always with me’

‘There are several highway sections reserved for cars with high levels of automation’

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Scenario 2: Revolution in Individual Mobility Services

‘My car is my castle, what a convenience’

‘All highway sections are reserved for cars with a high level of automation’

‘Do not disturb: time to recline the seat’

‘It's great how the road operator is guiding my car through the jam, but I'm still working’

‘Robotaxis have taken over, especially in urban and rural areas’

‘Yes, I have my own fully automated car, but via my service package with my fleet operator’

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Scenario 3: Revolution in Collective Mobility Services

‘I let myself driven and serviced’

‘Mobility, a full-service package with all possibilities’

‘Finally, road traffic is fully efficient, with high occupancy rates’

‘Space efficiency with roboshuttles’

‘Intelligent mobility service providers think multimodally’

‘Less traffic, less jams’

‘No more car at home, but access to a full range of mobility services’

Learn more

Scenario Model Results (2060)

2020-2060	Scenario 1 Evolution	Scenario 2 Revolution in Individual Services	Scenario 3 Revolution in collective Services
Transport Cost	- 20 %	- 60 %	- 80 %
Passenger km	+ 30 %	+ 35 %	+ 40 %
% collective transport (today: 27%)	29 %	25 %	49 %
% rail (today: 22%)	16 %	15 %	21 %
Vehicle km Passenger Cars	+ 37 %	+ 95%	- 9 %

- No scenario is a target vision
- Disruptions will lead to lower costs and induced traffic
- Only a revolution in collective services will reduce vehicle kilometers
- Rail might lose market share

Back to menu

Trade-offs and Challenges

Road - Rail: Motorized transport wins thanks to convenience potential and cost reduction through automation. Will collective mobility win?

Ownership - Service: How rational is mobility behavior? Is it possible to significantly reduce the ownership of the means and tools of mobility?

‘Me’ or Technology: Do I accept artificial intelligence? Do I want to ride with others? Is it possible to develop intelligent and reliable control systems?

Safety vs. Capacity: What is the potential of smarter connected vehicles and infrastructure? Do they reduce the need for infrastructure expansion?

Economies of Scale - Local vs. Global Players: The optimal degree of competition: how much power should global data and mobility providers have?

Price Reductions and Rebound: Is it possible to deal fairly and socially with the resultant productivity effects?

Back to menu