

Using MATSim for the long-term forecast of passenger demand in Switzerland

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MATSim User Meeting 2023





Transport modelling landscape at SBB



Goal of travel demand modelling at SBB.

- Service planning
- Fleet and infrastructure planning
- Financial planning
- Corporate strategy

SBB's simulation landscape SIMBA: combining macro- and microscopic transport modelling.

SIMBA Bahn

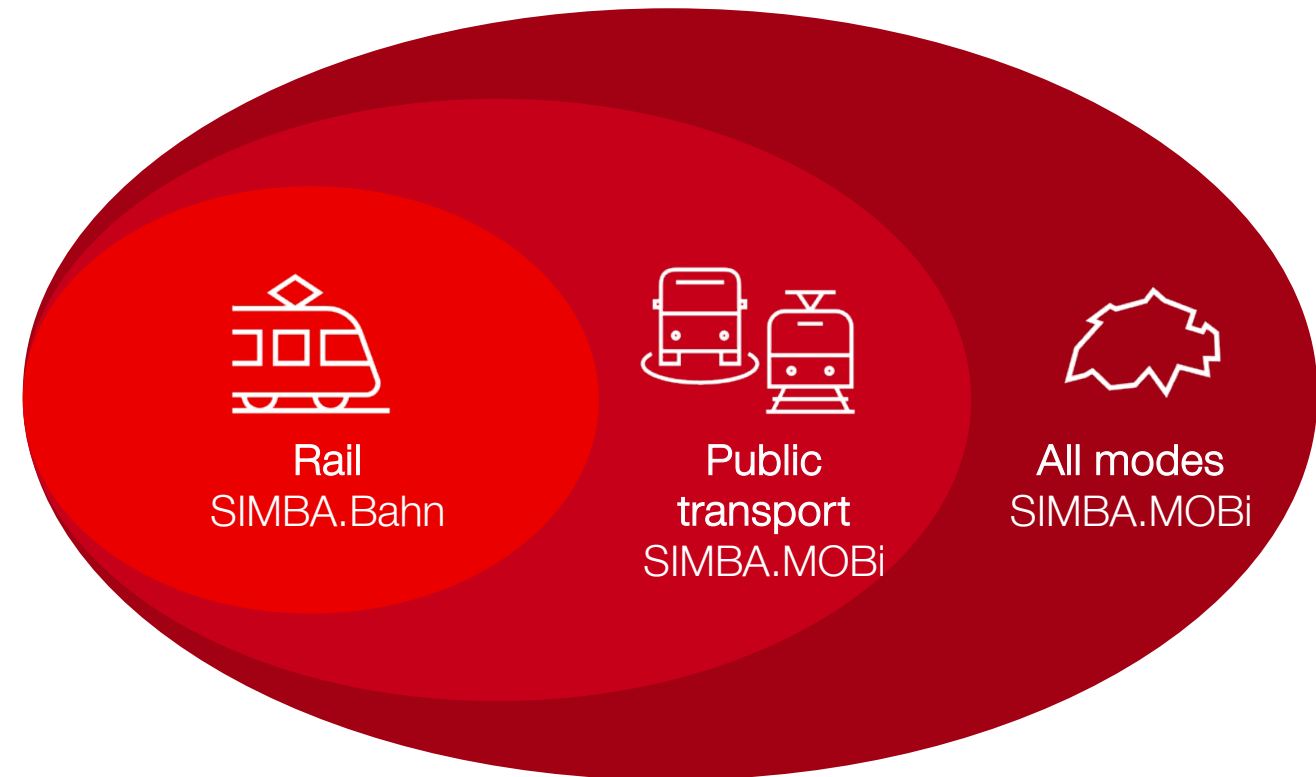
Rail planning and optimization

- Long-time experience
- High-precision demand based on ticketing and survey data
- Macroscopic
- Visum based

SIMBA MOBi

Forecasts and behaviour

- Multimodal
- Microscopic, door-to-door
- 24h plans & activities
- MATSim based
- Demand predictions for 2050+



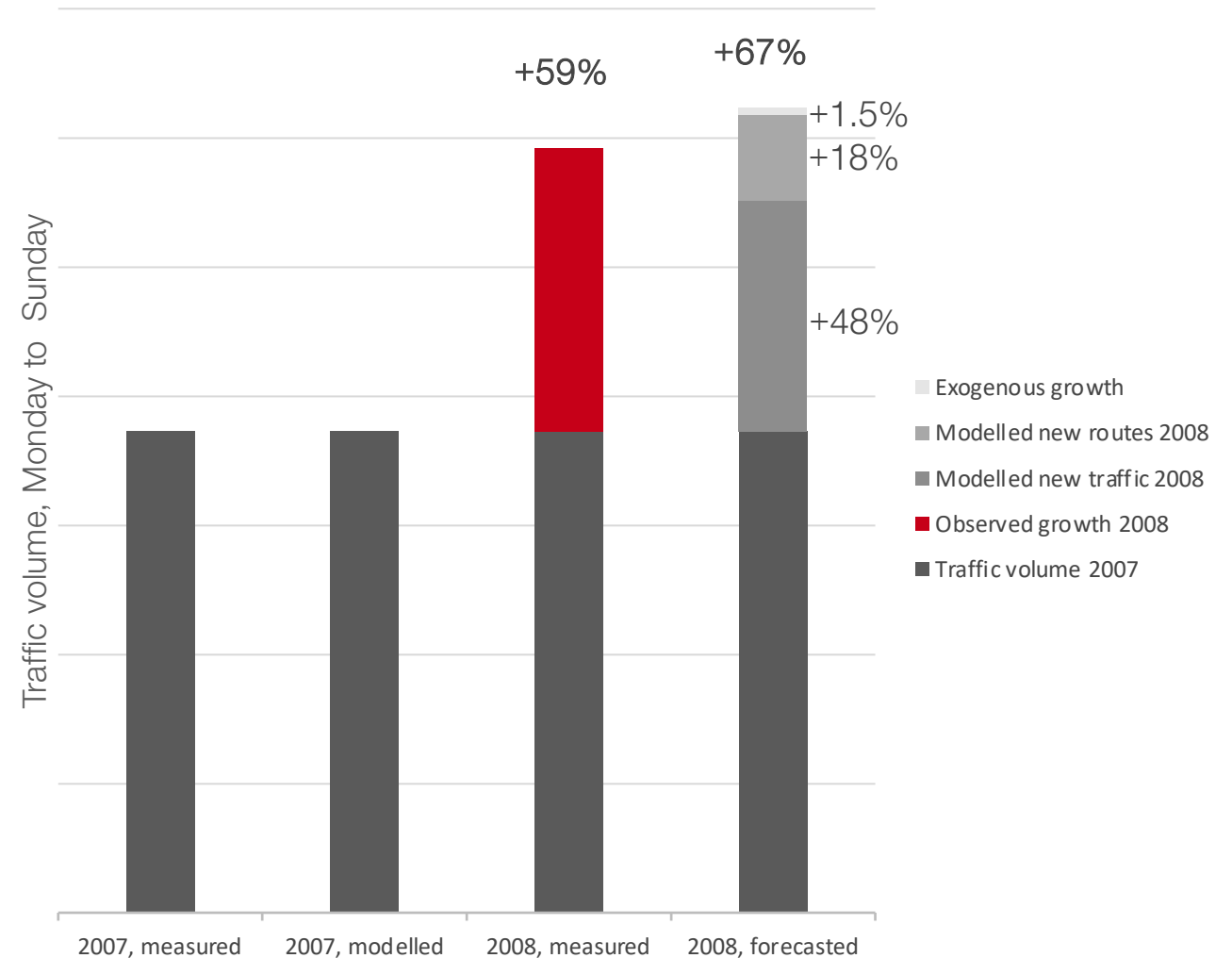
Prediction success.

Lötschberg Base Tunnel opened in June 2007.

How did the model (NSVM) predict the effect of the new offer?

These number represents the traffic flow on:

- Lötschberg railway line (opened in 1913)
- Lötschberg Base Tunnel



Imagining Switzerland in 2050



"Railroad carriages are pulled at the enormous speed of fifteen miles per hour by engines which, in addition to endangering life and limb of passengers, roar and snort their way through the countryside, setting fire to the crops, scaring the livestock, and frightening women and children. The Almighty certainly never intended that people should travel at such break-neck speed."
Martin Van Buren

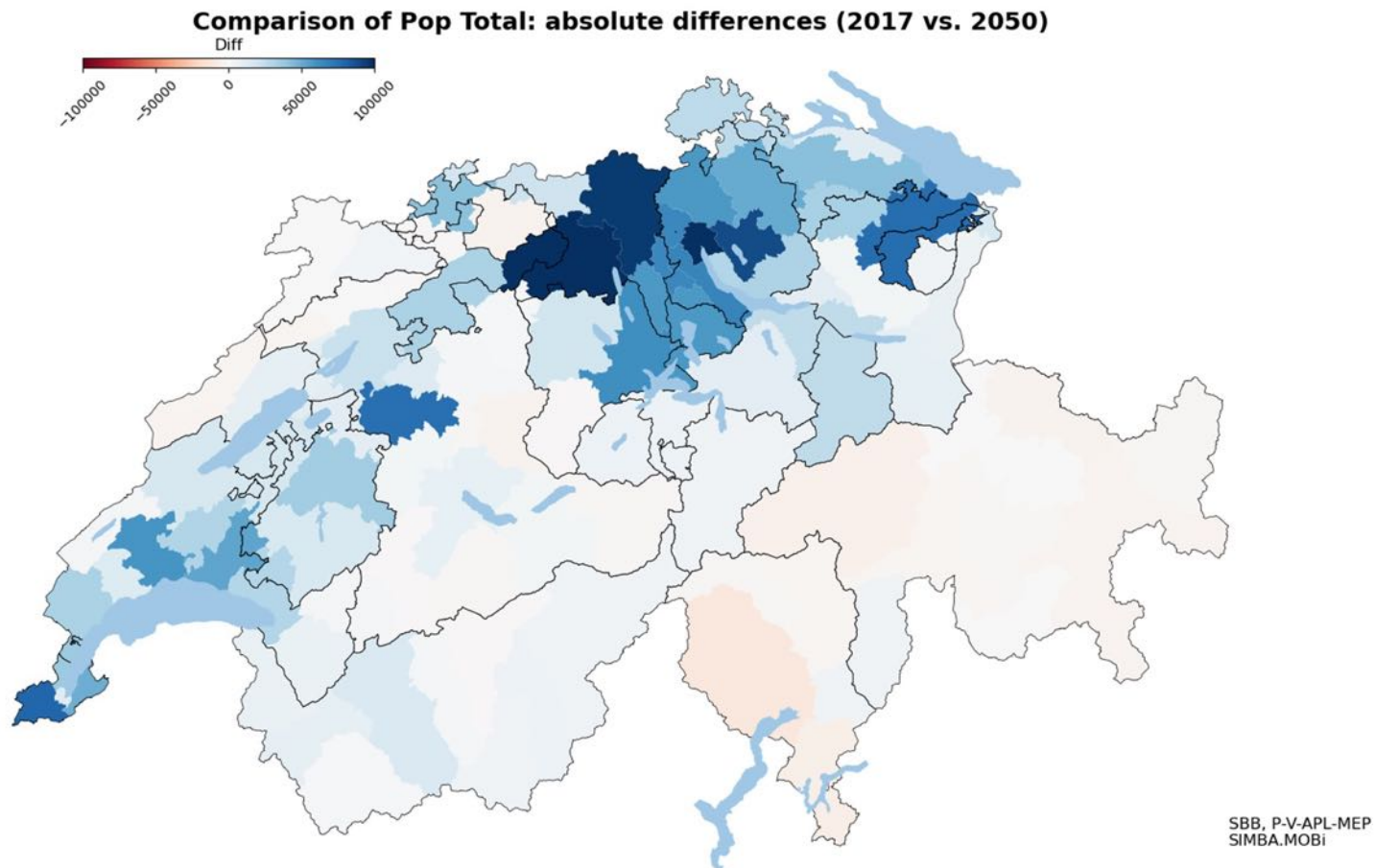
A lot of assumptions are provided by the federal government

	2017	2030	2040	2050
 Residents (million)*	8.5	9.4	10.0	10.5
Employed persons (million)*	4.8	5.0	5.1	5.2
Assumed Timetable	Ist 2017	AK BAV 2025	AK BAV 2035	AK BAV 2035
 Percentage of subscriptions > 18 yrs.	42.5%	43.6%	44.7%	44.5%
Private cars per 1000 inhabitants*	535	525	502	480
Autonomous vehicles (AV)			Some	Stronger
 Development of work from home	As surveyed	According to SBB internal assumptions «Work Anywhere»		

* Source: Federal Transport Outlook

<https://www.are.admin.ch/are/de/home/mobilitaet/grundlagen-und-daten/verkehrsperspektiven.html>

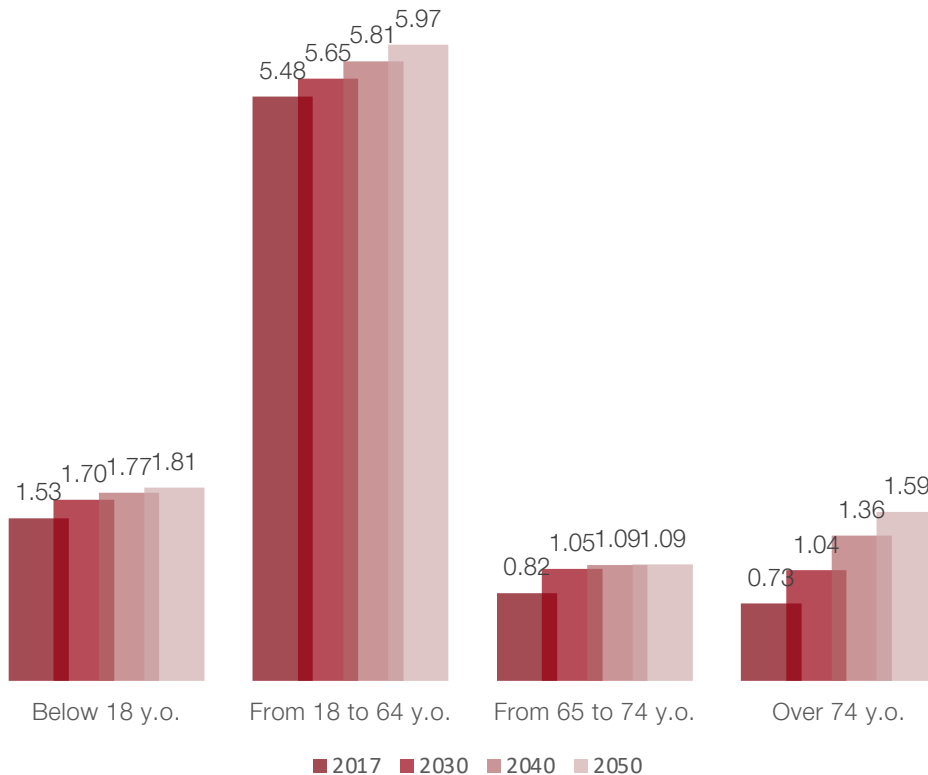
Expected regional population development



- Strong population growth expected in commutable distances to Zurich, the region around Bern and lake Geneva
- Absolute decline in population in rural and mountainous regions
- Source: Swiss Federal Office for Statistics, reference Scenario

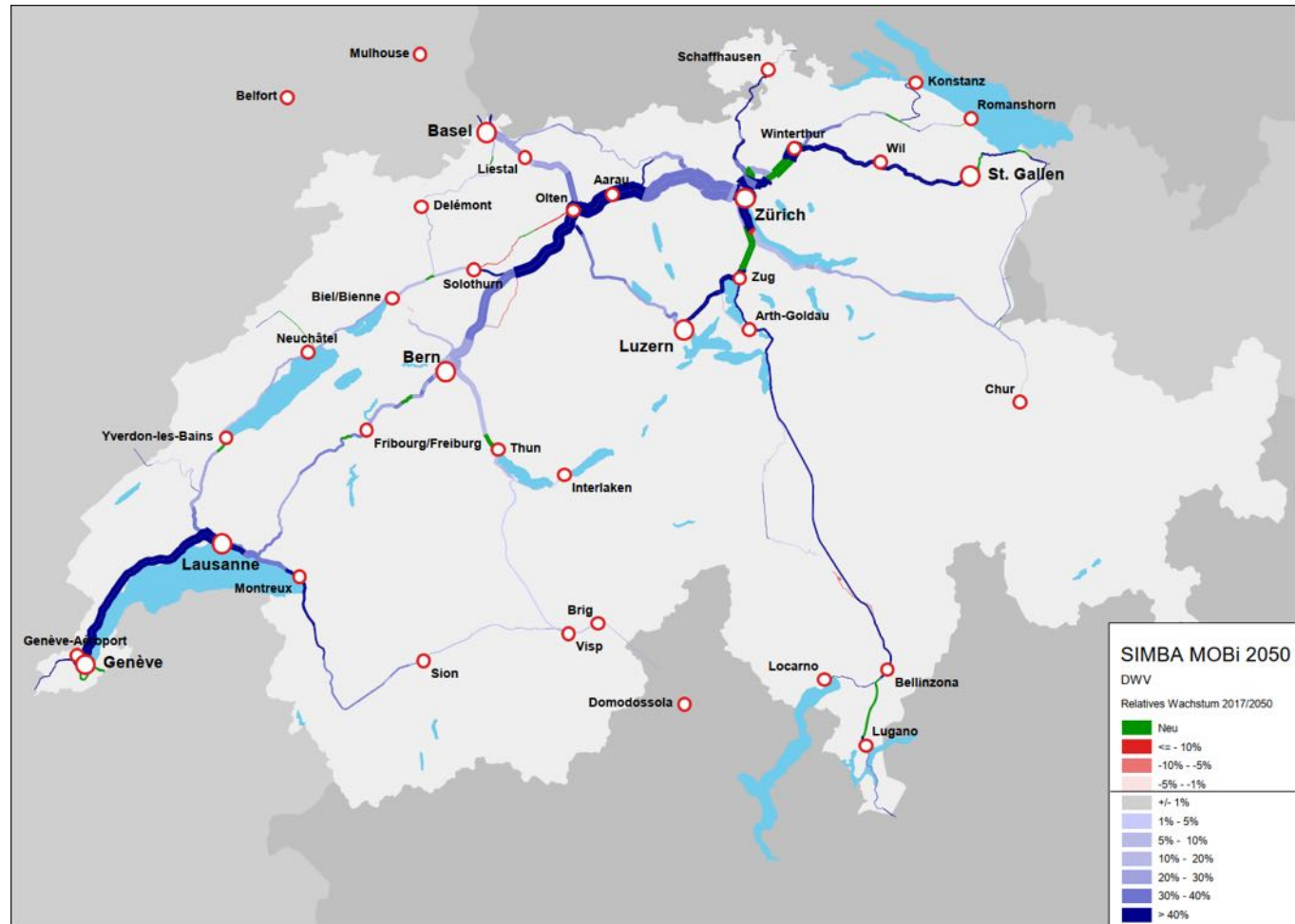
Expected demographical development

Population by Age (Mio)



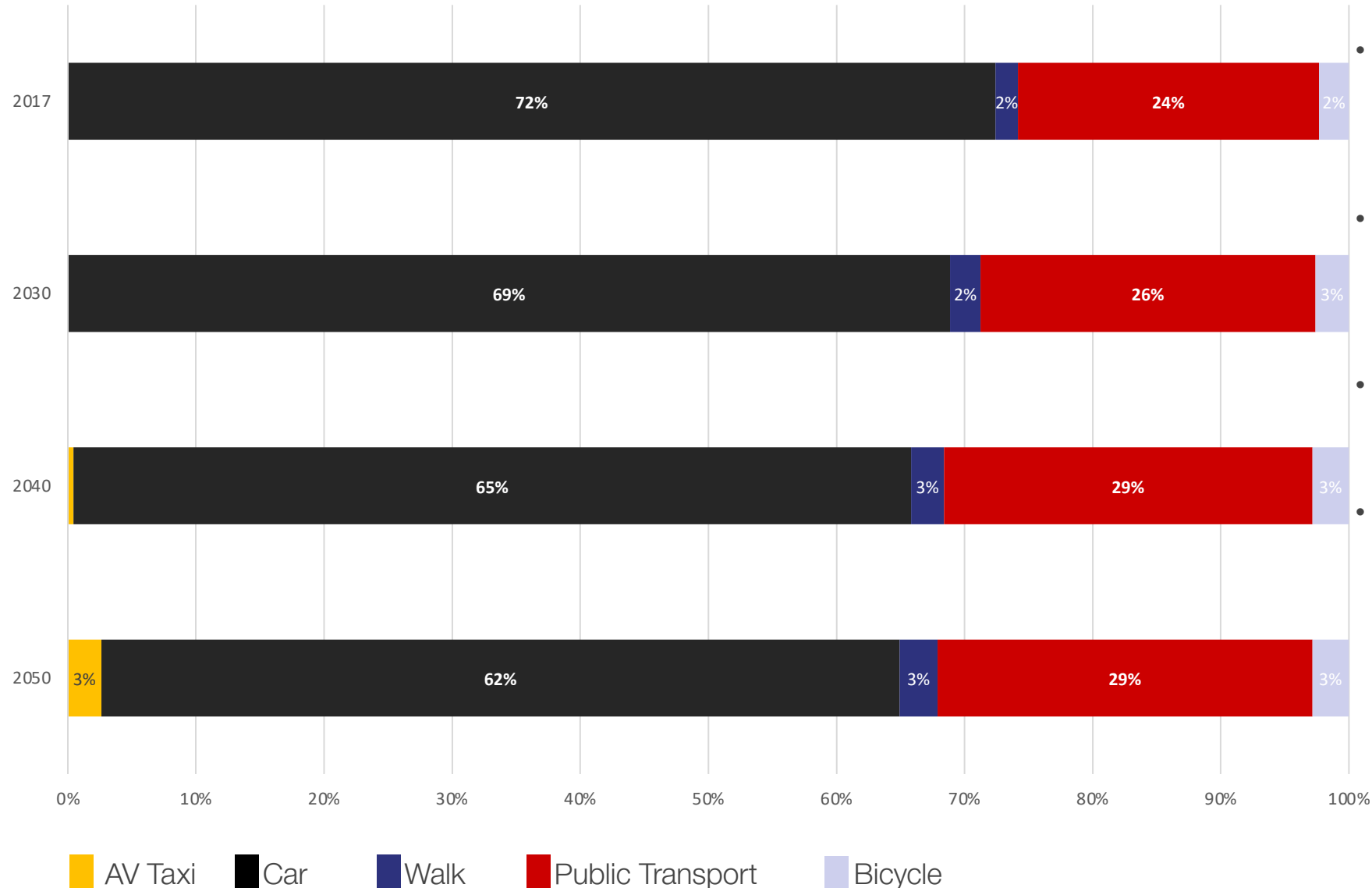
- Elderly population will double, strongest growth in absolute numbers
- Travel demand will shift further towards leisure and other activities

Expected Development of railway demand along corridors



- Expected growth 2017-2050: 37% in passenger kilometers
- Passenger rail demand will continue to grow strongly along the big commuter corridors (Bern-Basel-Zurich and Geneva-Montreux), with growth rates of 40% and more.
- Leisure related travel crossing the Alps is expected to grow
- Smaller rail lines in rural areas may even see a decline
- Development along touristic lines: Difficult to forecast

Expected shifts in modal split (by distance)



- Car (including ride) remains the dominant transport mode, but its market share is likely to decline
- Public transport: Increase in modal share, mostly due to planned railway expansions
- Bike: Expected growth continues especially in cities
- AV-Taxis: Scale up expected in the 2040s, expectations in Switzerland rather conservative (Transport Outlook: even less optimistic)



Model applications

Timetable concepts 2050+



Assumptions
(first/last mile, regulation)



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Assumptions based on Transport
Outlook 2050 by the Federal
Office of Spatial Development



SBB CFF FFS

Different future scenarios



Railway system



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Expansion step 2035
(AS 2035)



SBB CFF FFS

New railway concept(s)

1

SIMBA.MOBi 2050
(Base case)

„Schedule
effect“

2

SIMBA.MOBi 2050
with new rail concept

3

Modified SIMBA.MOBi
2050 with existing rail
concept

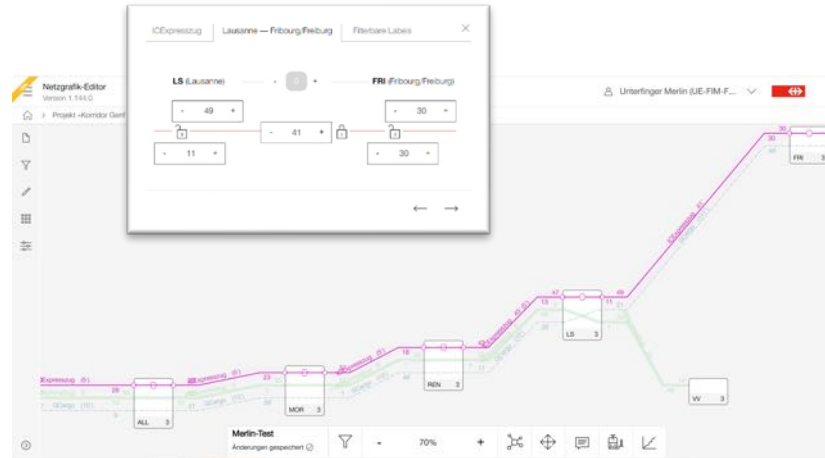
Our story!

4

Modified SIMBA.MOBi
2050 with new rail concept

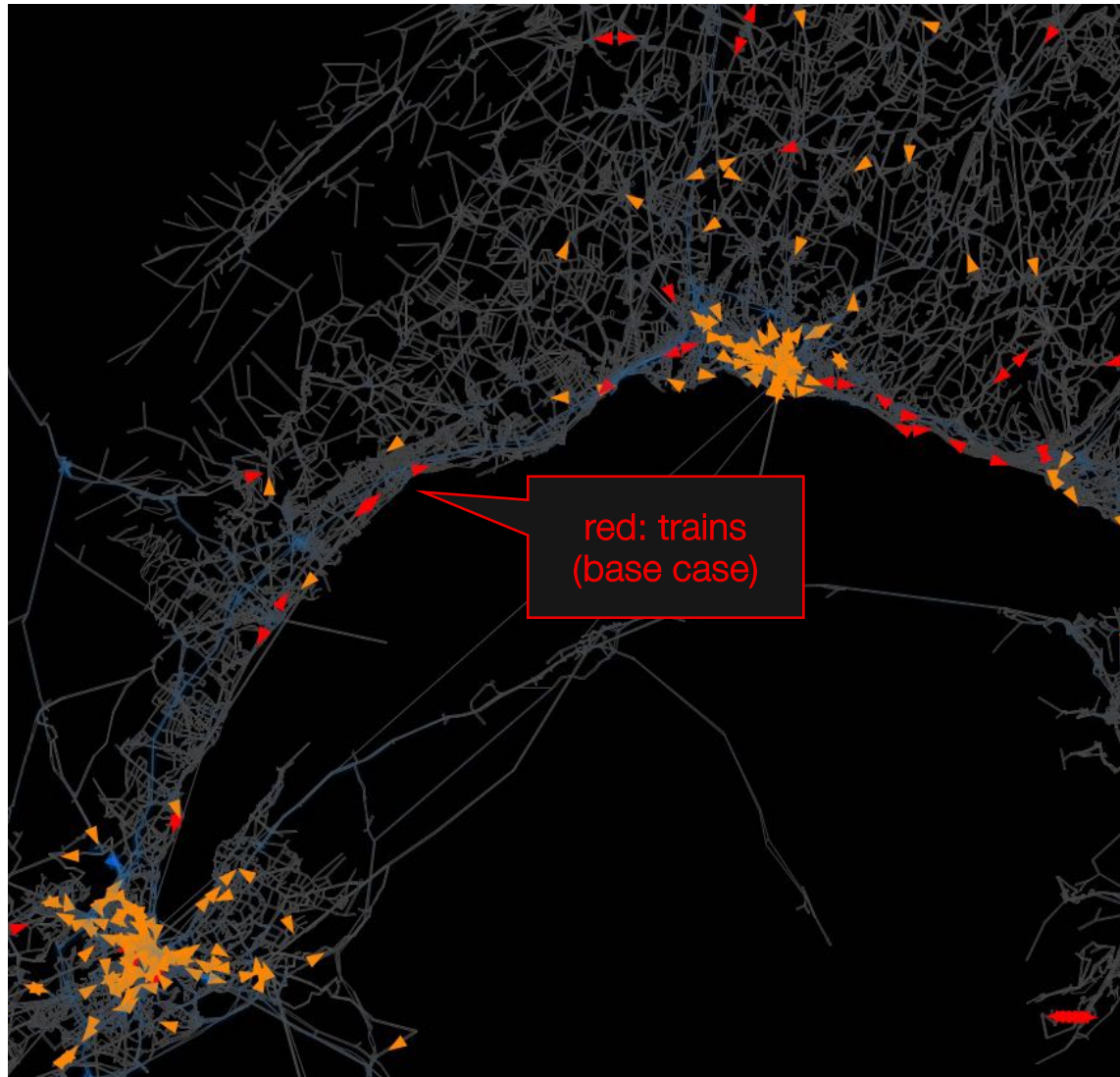
„Scenario
effect“

Workflow



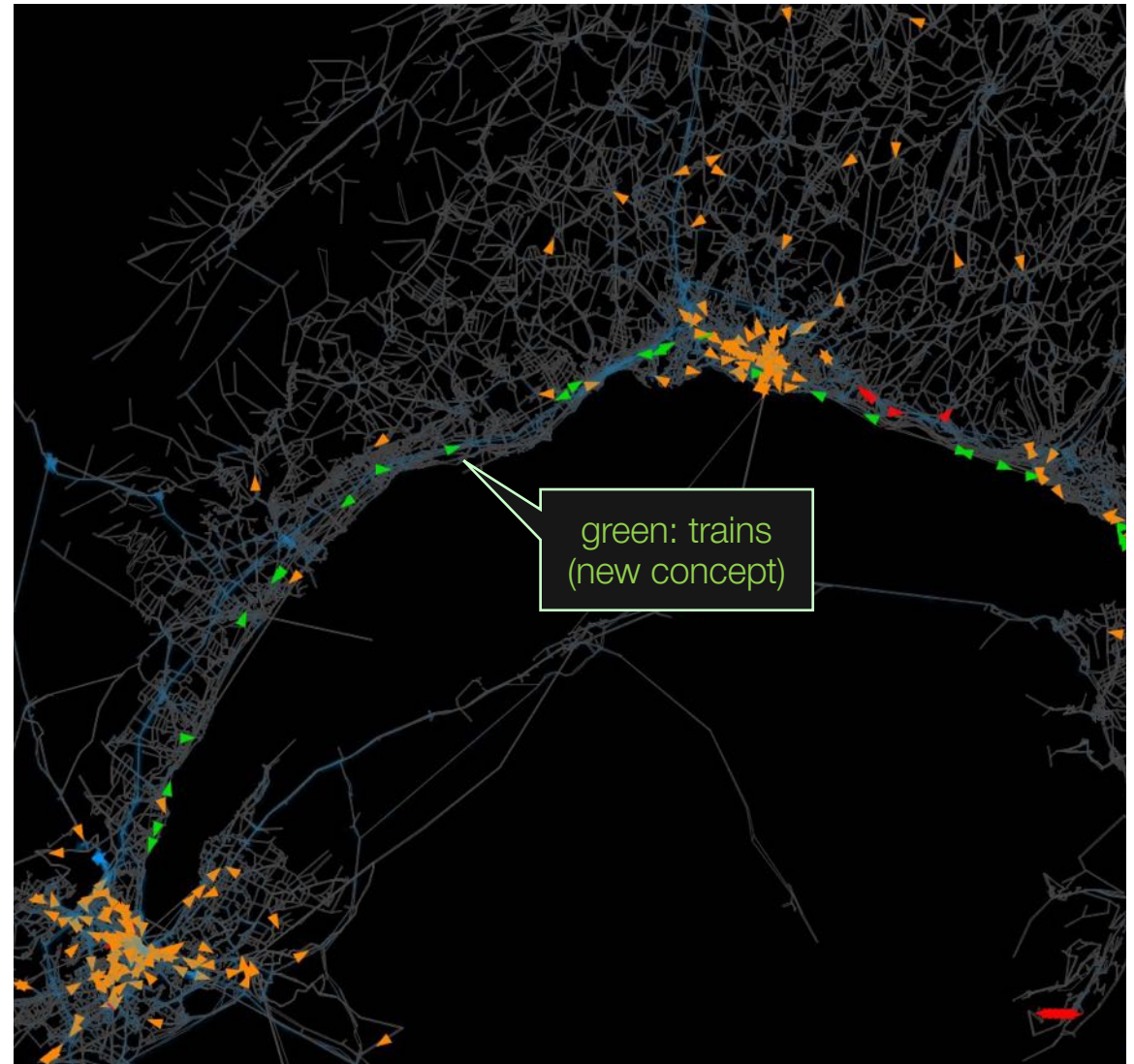
- Train schedule concepts are developed using a timetable editor (SBB internal tool).
- The schedule is converted into the MATSim format (credits: Merlin Unterfinger).
- The SIMBA.MOBi base case version is modified:
 - Remove the old train schedule (or part of it).
 - Add the new train schedule.
 - (Change further model elements.)
- Run SIMBA.MOBi and simulate the demand reactions.
- Compare the cases 1, 2, 3 and 4; analyze the modal split, boarding/alighting passengers per stop etc., required train capacities, service quality per origin-destination-relation, ...

Base case



orange: bus, tram; blue/transparent: car

New timetable concept





Danke, merci
& grazie.