MARKET ORIENTED INFRASTRUCTURE MANAGEMENT

EXPLOITING THE POTENTIAL OF THE GBT

JUNE 1, 2018

Annual Event

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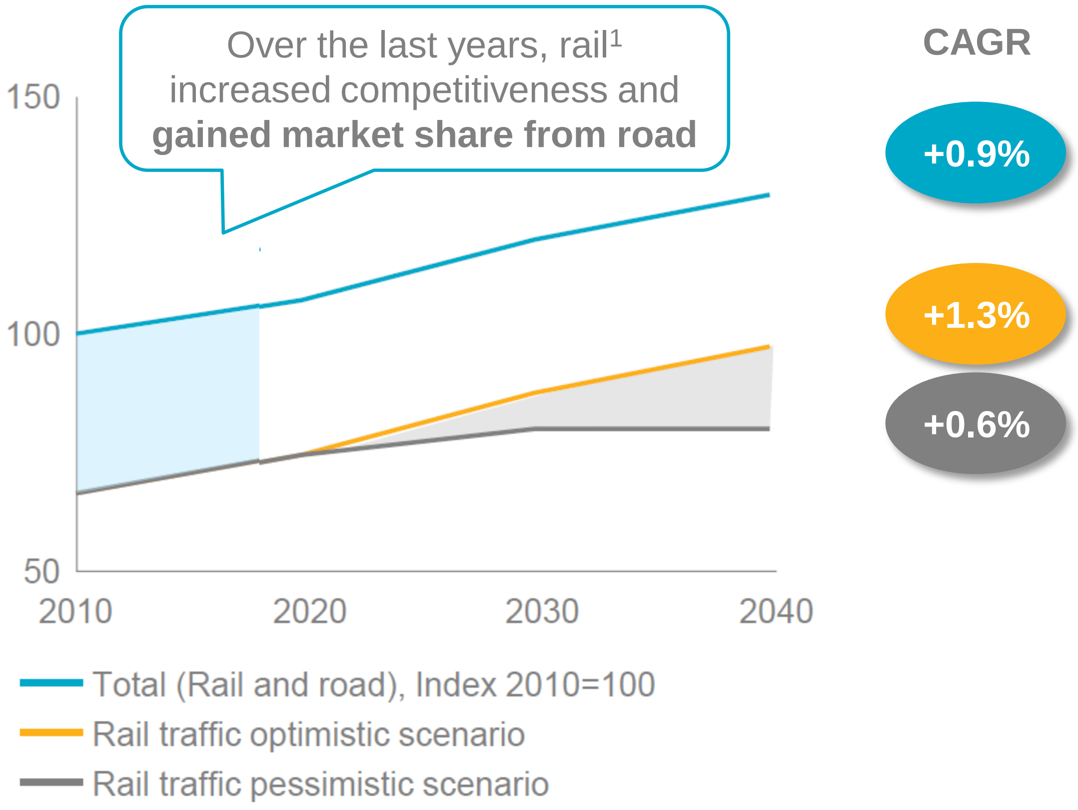
Strong growth of rail and intermodal on the North South Axis in the past – future depends on competitiveness of rail, given disruptive road trends

Development of transit traffic in Switzerland

In tkm, indexed to total traffic in 2010



Source: ARE, BFS, Eurostat, Country reports, Oliver Wyman analysis
1. Rail including intermodal

Scenarios

Optimistic scenario (over proportional growth)

- Rail continuously profits from regulations (night-time ban, heavy vehicle charge LSVA, …)
- Improved acceptance/attractiveness of rail (innovative transit offer, e.g. charging of E-trucks in transit, …)

Pessimistic scenario (under proportional growth)

- Increasing productivity of road vs. rail
- Disruptive technological trends adapted faster on road (autonomous driving, E-trucks, …)
- Further decrease of punctuality and reliability of rail

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Road transportation will continue to benefit from future developments, rail will be subject to further increasing competitive pressure

Trends and their impact on competition between road and rail

Innovation cycles and digitalisation

- Significantly shorter innovation cycles in road transportation (~ 5 years) than in rail transportation (25–30 years)
- Digitalisation drives innovation through newly initialised, holistic solutions and disruptive "asset-light" players

New technologies/ productivity gains for trucks

- Significant productivity gains for trucks through
  - Gigaliner (> 60t and 157m^3 volume) with higher transportation volumes and lower transportation cost
  - Autonomous driving and new fuel-efficient engines facilitate further cost reductions
  - Currently banned from transit in CH

Decreasing financial support for combined transport

- Total reduction of financial contributions to combined transport of CHF 120 MM until 2024

Source: Expert interviews, Oliver Wyman

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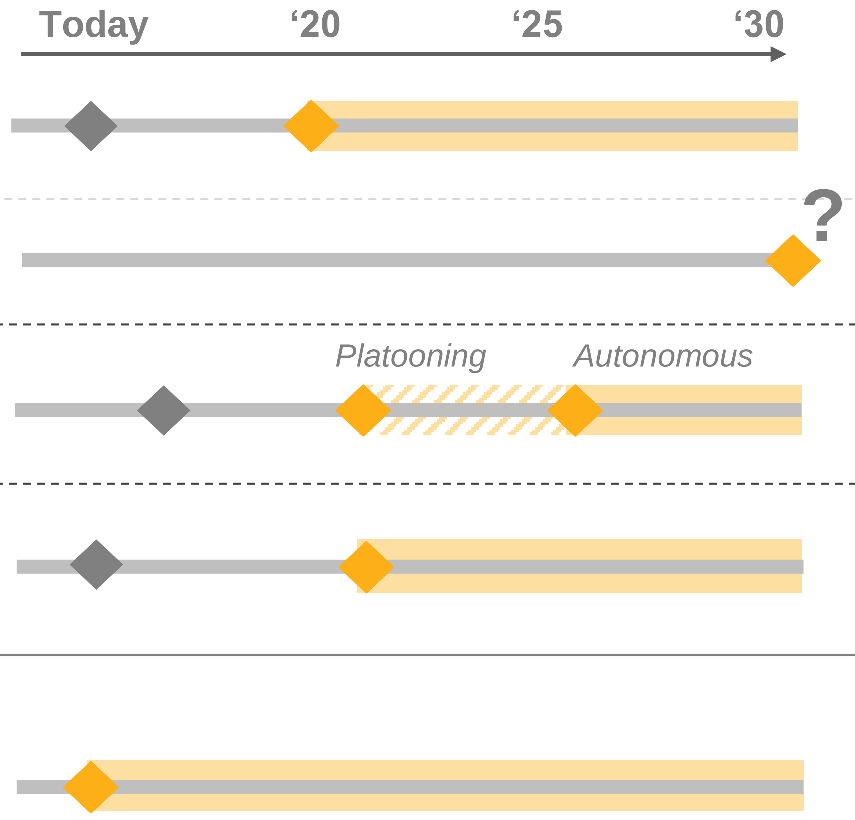
Disruptive productivity gains in road transportation to be expected due to innovations and increasing fuel-efficiency

Core upcoming road technology innovations

Vehicle Technology



Impact

Gigaliners[1]

- 57% more volume
- 20–25% lower transport costs
- Ban in Switzerland
- E-mobility as potential catalyst

Self-driving trucks

- Higher transport reliability
- ~20% lower transport costs

Fuel-efficient engine technologies

- Up to 15% lower fuel costs
- Cumulative with other innovations

Digital Innovations

Connectivity platforms and marketplaces

- Price transparency
- Utilisation and productivity increases (trucks, drivers, etc.)

◆ Prototypes exist ◆ Industrial maturity achieved ▬ Deployed/In production

1. Technically, the solution is available now. Effective launch of production and, hence, industrial maturity, is dependent on approval by national regulatory bodies; Gigaliners with > 60t and 157m3 Volume
Source: Oliver Wyman analysis

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Going forward, rail, intermodal and road will compete on a wide range of service criteria with reliability and lead time as central differentiating factors

Current service fulfilment capability

Service criteria		Conventional Rail	Intermodal	Road	Expected future relevance for clients[1]
"Your fair market share"	**Lead time**				
	Cost of transport				
"Basics"	Proactive information				
	Trouble shooting support				
	Reliability/punctuality				
	Tracking and tracing				
	Capacity avail. for loading				
"Differentiation"	Time to market				
	Delivery times				
	Value added services				
	Ease of use				

Source: several Oliver Wyman surveys

Current fulfillment level

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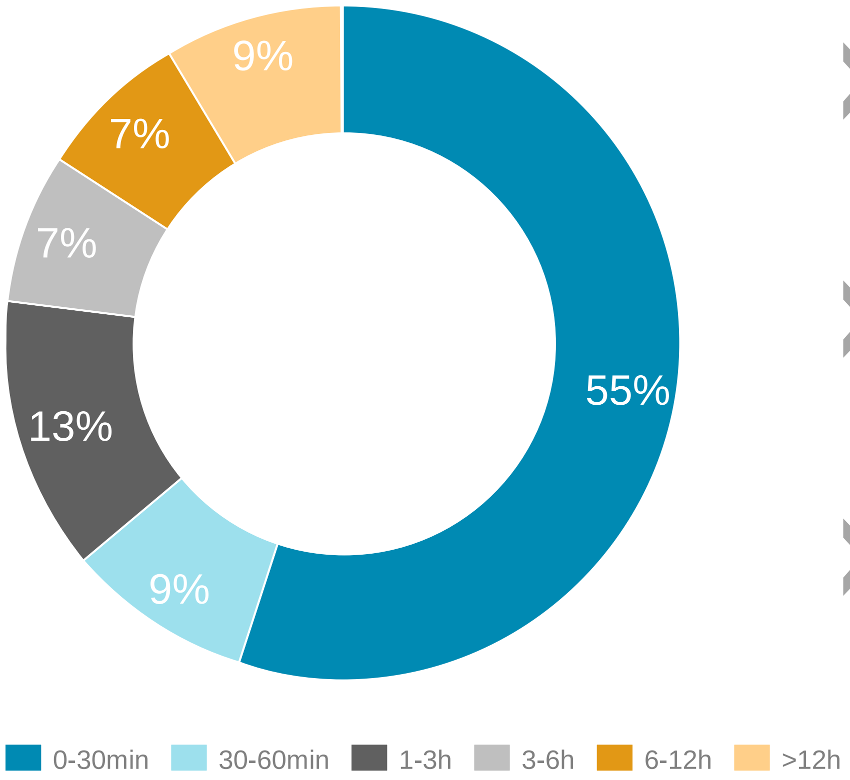
Punctuality was identified as a main problem for intermodal transport – only partially due to disruptive events in D, CH and I

Average delays of transalpine intermodal traffic in 2016/2017 (excluding Rastatt effect in Q3 2017)



- Almost half of all transalpine intermodal traffic was delayed by 30 mins or more
- Significant delays over 3h, accounting for ~25% of all delays, were by numerous diversions, line closures, construction sites and a shortage of conductors
- Ramp-up difficulties following the closures of Rastatt and the Luino line in Q3 2017 increased delays in Q4

Source: BAV

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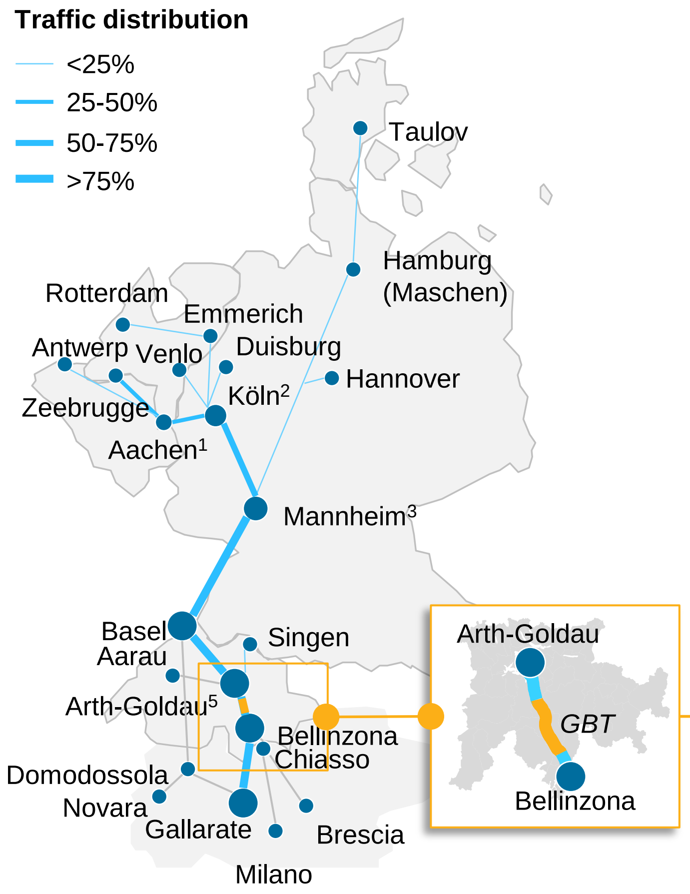
Positive effects with the opening of the Gotthard-Base-Tunnel (GBT), but the market on the North South axis is over 900 km on average

Majority of relations on NS-axis lead through GBT

Relation to Busto A. / Gallarate	Modelled lead time (in h)[1]	Distance (in thd km)
Taulov	28	1,5
Zeebrugge	25	1,3
Antwerpen Combinant	24	1,1
Antwerpen HTA Quai	24	1,1
Rotterdam RSC	22	1,1
Venlo	20	0,9
Duisburg Ruhrort Hafen	19	0,9
Duisburg Rhein. Dkt	19	0,9
Hannover-Linden-Hafen	18	1,0
Koeln Eifeltor	16	0,8
Ludwigshafen KTL	12	0,6
Singen	8	0,3
Basel Weil	6	0,3
Average	19	0,9



GBT effects

Time savings of 45 minutes on average were achieved through:

- Reduction of total distance travelled by 30km
- Decreased waiting times between Basle and Bellinzona
- Less stops for changing and adding additional pushing locomotives

Cost savings potentials were realized through:

- Reduction of maintenance expenditures
- Reduction of the number of locomotives
- Cost rationalization effects due to the improvements

1. Modelled lead time 2017 in h, Aarau and Birrfeld not modelled due to inclusion in Basel-Gallarate trains, Hamburg Billwerder not modelled due to inclusion in Hannover-Gallarate trains, Herne, Rotterdam RSC and Singen only routes with S. terminal Gallarate modelled,Source: Hupac, Oliver Wyman
Modelled lead time may diverge from observed lead time

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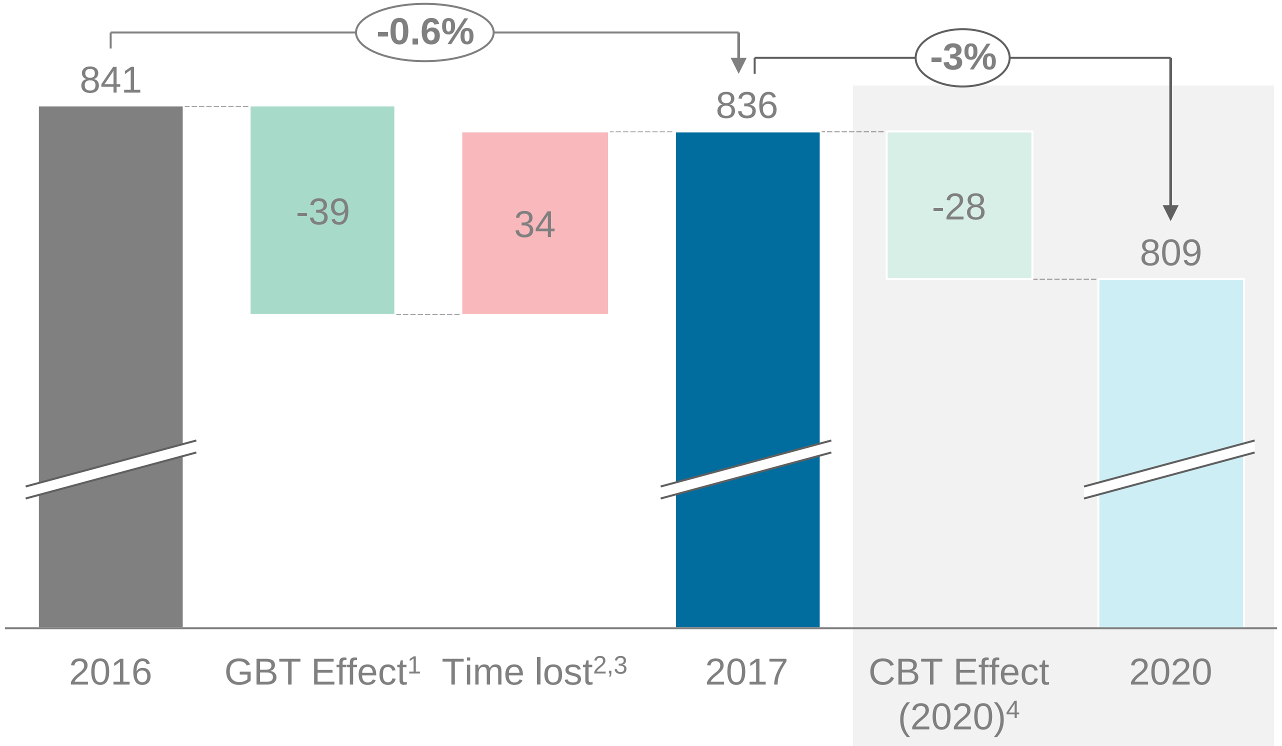
In fact, the timetable comparison 2017 vs. 2016 shows, that the positive GBT-effect is almost annihilated by deteriorations on other sections

Development total lead time 2016–2017

Sum of total lead time of all 50 trains in sample, in h



Only minor reduction of 0.5% in total lead time of all trains in sample 2016 vs. 2017

Positive GBT effect compensated by an increase in waiting time at transition point Basel as well as on other sections

The opening of CBT is expected to yield further reductions in lead time of 3%

1. Approximation based on avg. acceleration between Basel and Gallarate 2016–17 of ca. 45min (50x45min ≅ 38.5h), 2. Approximation based on avg. increase of waiting time in transition point Basel SBB of ca. 21min (50x33min ≅ 17.5h), 3. Derivation based on total lead time measured 2016/2017, avg. GBT effect and avg. waiting time increase in Basel SBB, 4. Approximation based on avg. estimated acceleration between Locarno and Lugano from 2020 of ca. 33min (50x33min ≅ 18.3h)

Source: Hupac, Oliver Wyman analysis

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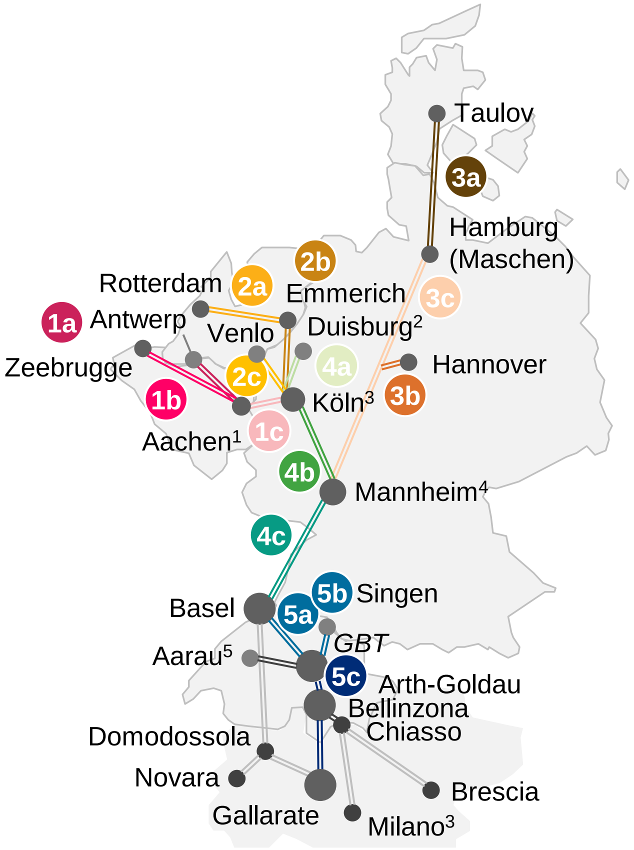
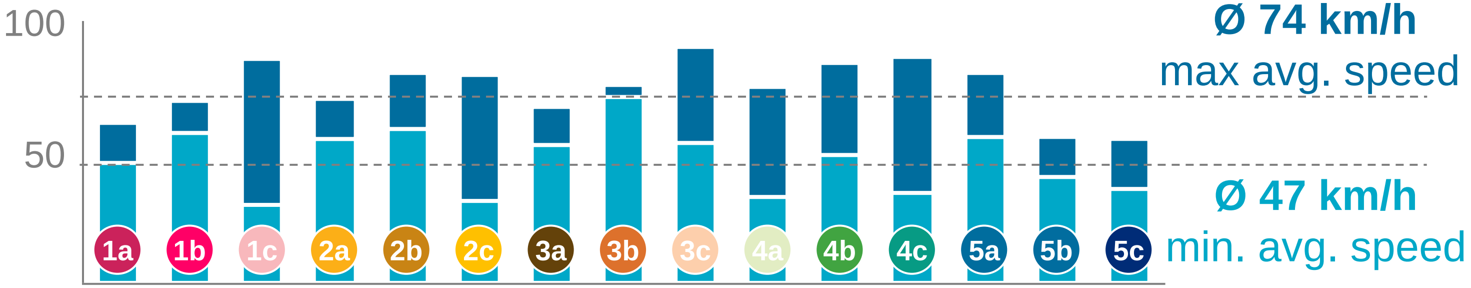
Large variability of average speed achieved both across and within section. Lead times show reduction potential across sections

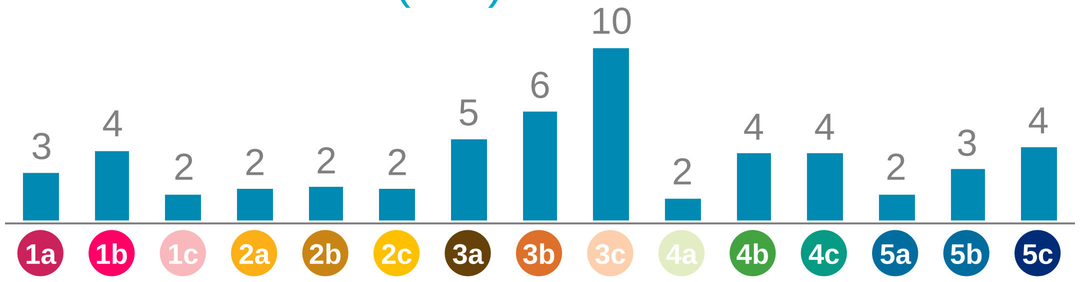
Track sections on NS-axis



Average speed per section



Modelled lead times (in h)



Up to 60min of lead time reductions can be achieved across sections

Source: Hupac, Oliver Wyman

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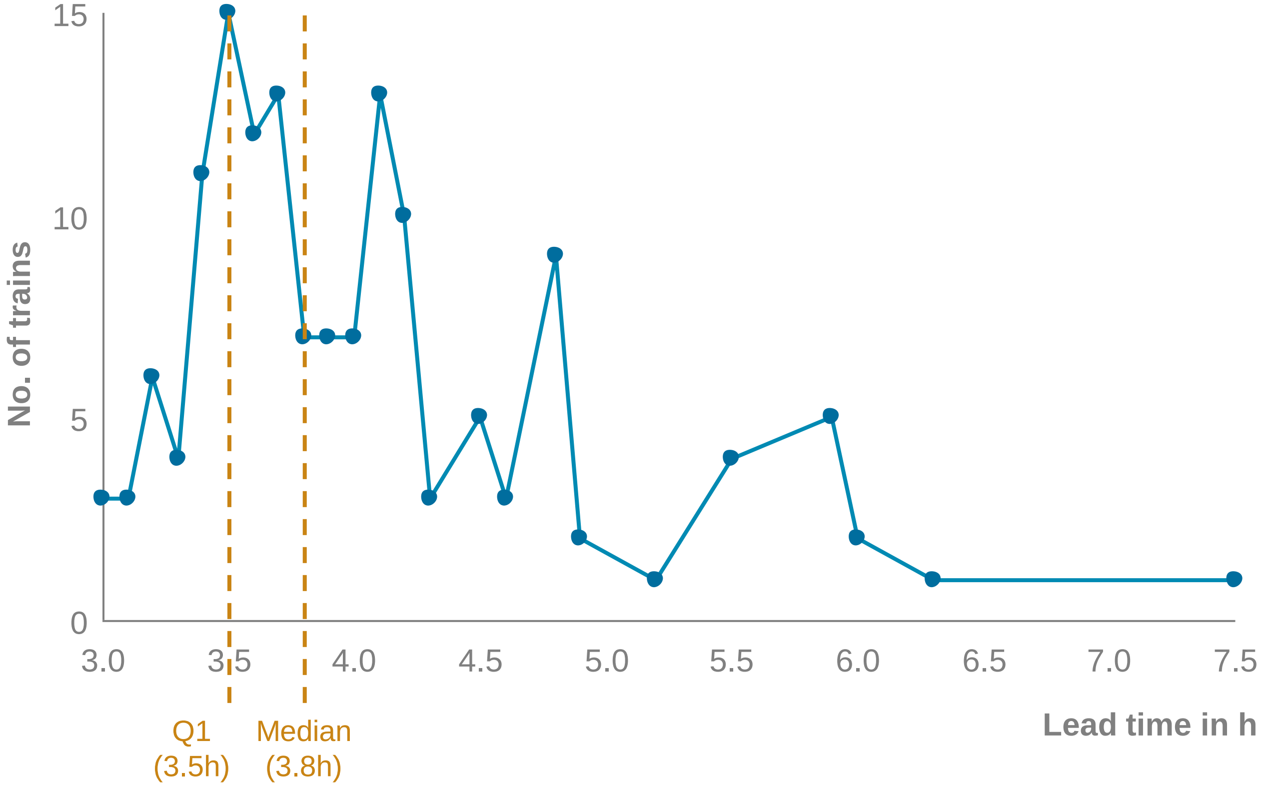
Lead times for the relation Mannheim – Basel show significant variability

Distribution of lead time

No. of trains[1] per week per lead time in h



High variability in the average travel speed (Avg. of 64 km/h vs. slowest of 34 km/h) lead to a broad distribution in lead time

Decreasing waiting times before border crossings as well as avoiding unscheduled stops during transit would reduce variability of lead times

Note: No. of trains per week depends on observations assigned to a certain operating point or section. Not all trains on a certain relation operate on same route. Values rounded to decimals. Section analysis may include trains operating on NS-axis, but not through GBT., 1. Multiple trains per observation, i.e. with same lead time
Source: Hupac, Oliver Wyman

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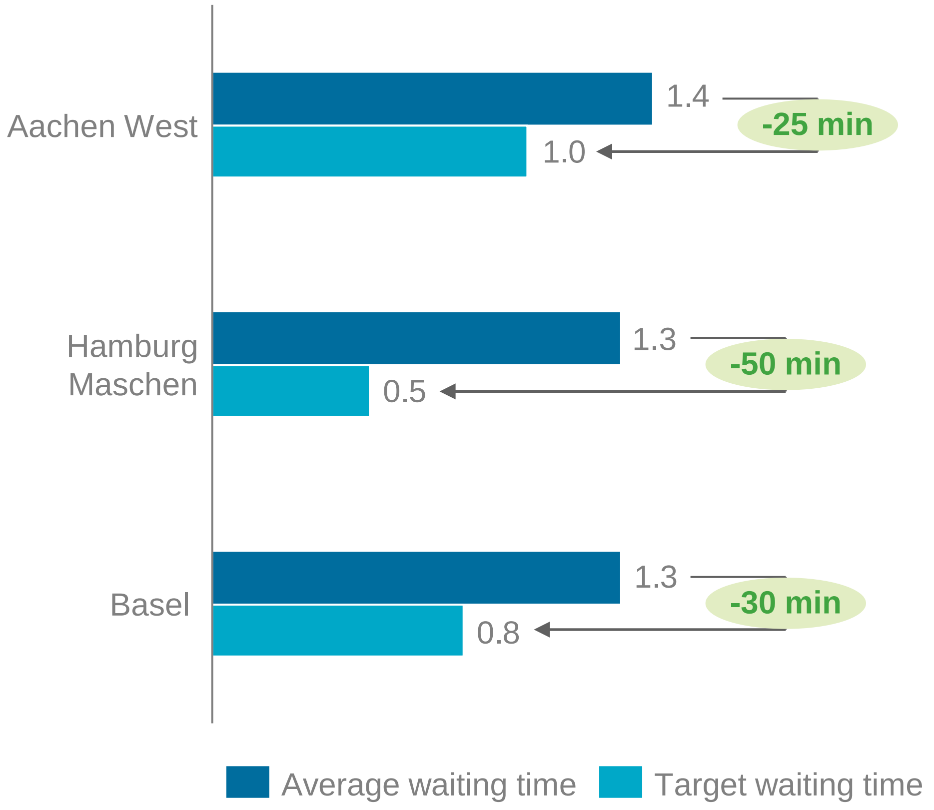
Waiting times across operating hubs exhibit large variability – with some showing significant potential for reduction

Modelling-relevant operating points on NS corridor

Several major hubs show potential for waiting time reduction (exemplary)



1: Waiting time reduction achieved through: Reduction and optimisation of buffering, while ensuring quality levels, optimised planning of loco and driver changes, path harmonisation to reduce waiting time optimised terminal planning and operations to reduce necessary stops due to closed terminals

Source: Hupac, Oliver Wyman

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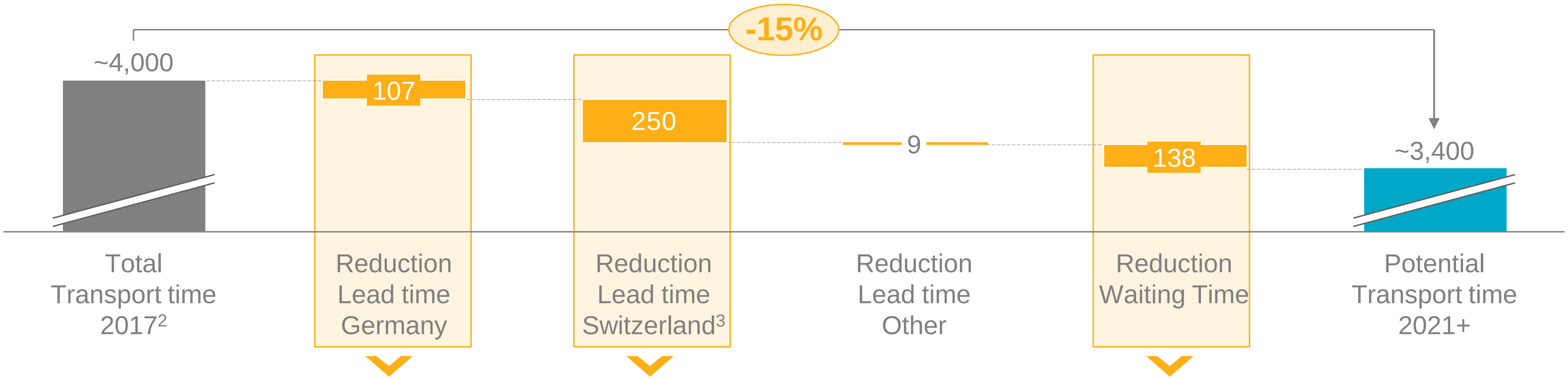
Acceleration potential of approx. 15% was identified – Realisation requires joint efforts by all parties to achieve improvements even before 2021

Breakdown of modelled potential for transport time reduction

Total[1] modelled transport time 2017 vs. 2021+ estimation, in h



2.7% reduction in total transport time through moderate acceleration of slower traffic in Germany

6.4% reduction in total transport time due to extensive infrastructure investments and full GBT-effect post 2020

3.5% reduction in total transport time due to potential to reduce buffering and optimise path planning

1. For all 222 trains per week included in model, 2. Model based, 3. Clear potential due to extensive infrastructure investments to become fully effective after finalisation of 4m-corridor works (including Ceneri base tunnel), reduction of lead times throughout Switzerland due to leverage of full GBT-effect post construction activity in 2020

Source: Expert interviews, Hupac, Oliver Wyman analysis

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The current infrastructure management process is characterized by four main deficiencies

Representation of current infrastructure management process and consequential difficulties

Advisory phase and path studies → Placement of path orders → Draft network timetable development → Coordination phase → Path allocation → Operations

Market requirements

1. Limited market conformity and market focus

- Insufficient consideration of market capacity requirements
- Path requests are submitted before demand pattern is still clear
- Different standards, e.g. train length

Operative elements

2. Path coordination

Domestic focus leads to path-fractures at national borders and lack of continuous path capacity along main corridors

3. Construction activity

Exacerbated impact of interruptions through lack of coordination in network expansion and construction planning

4. Day-to-day operations

Unplanned stops during transit and longer waiting times resulting in increasing lead times

Source: Rail Net Europe, Expert interviews, Hupac, Oliver Wyman

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Integrated corridor management Rhine-Alpine from planning to operations, in order to exploit the GBT productivity potential and fulfill market requirements

Examples of levers for improvement in current corridor management

Coordinated construction activities

- Corridor view: minimizing end-to-end impact
- Coordination of short-term interruptions
- Bottleneck centred planning

Coordinated long-term planning

- Cross-border path planning
- International coordination on development of network and corridor including terminals

Harmonized operating models

- Harmonisation of standards
- Alignment of prioritisation and dispatching rules

From domestic to corridor management

- Implement centralised international corridor management
- Implement international rail contingency and IM / RU crisis management
- Ensure short-term single track re-start on EU corridors

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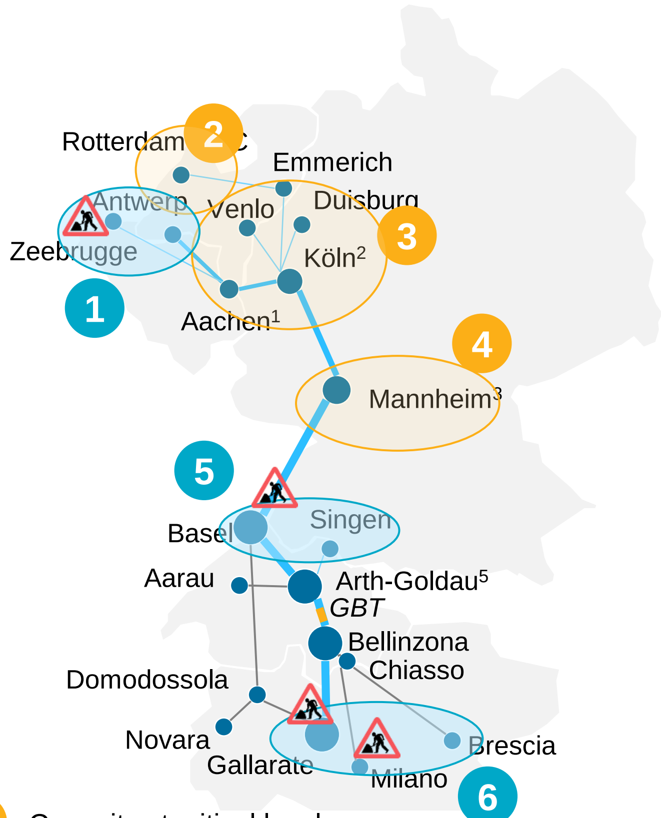
Coordinated management of terminal capacities along the axis as an integral part of an efficient end-to-end corridor management

Terminals across NS-corridor show different capacity utilizations



! Capacity at critical level

Terminal groups	Current capacity[1]		Future capacity[2]	Notes
1 Belgium		→		Expansion of rail infrastructure around the port of Zeebrugge
2a Rotterdam continental		→		No new projects
2b Rotterdam maritime		→		No new projects
3 West-Germany & Rhine Area		→		Projects outstanding
4 Central-Germany & Main Area		↘		No new projects
5 CH North		↗		Projected terminal Gateway Basel Nord (trimodal handling facility)
6 Italy North		↗		Several projects (E.g.: expansion of handling facilities in Milano and Busto / Gallarte in progress)

Capacity available — Capacity limited — Capacity highly limited — → Trend

1. Estimation based on Hupac expert input, 2. Under consideration of traffic development
Source: Hupac, Oliver Wyman

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All involved parties – Rail freight operators, infrastructure providers and Hupac – can benefit from improved operations on the North-South corridor

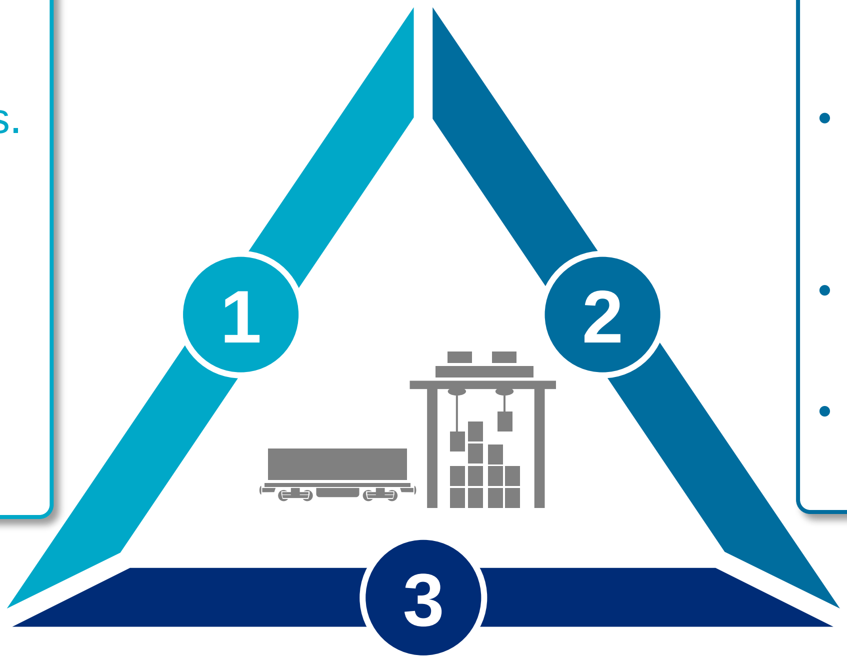
Railway undertakings

SBB Cargo International

DB Cargo

MERCITALIA RAIL
GRUPPO FERROVIE DELLO STATO ITALIANE

- Higher competitiveness of offer vs. road and potential for higher transport volumes in case of transport mode shift
- Higher productivity and efficiency of resources (locomotives, personnel, etc.)



Infrastructure provider

SBB CFF FFS

DB NETZE

RFI RETE FERROVIARIA ITALIANA
GRUPPO FERROVIE DELLO STATO

- Potential for better and higher utilisation of existing infrastructure by freeing up of capacity
- Potential to allocate additional demand on "freed-up" capacity
- Balancing of needs of passenger and freight transport

Intermodal operators

- Higher competitiveness vs. intra- and intermodal competition due to faster lead times and better punctuality
- Lower cost due to higher productivity of resources (wagons, etc.)

HUPAC
moving together

Source: Oliver Wyman

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